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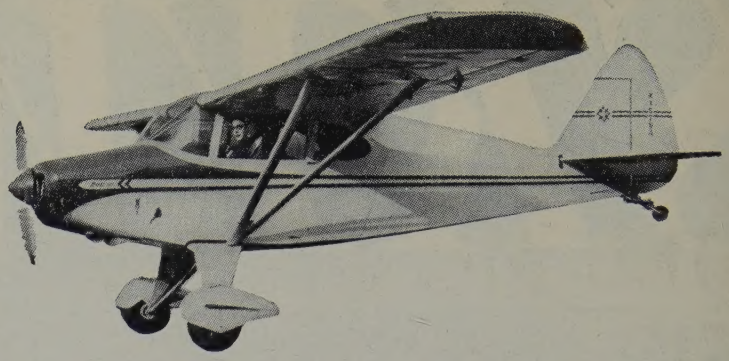

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TRAIN IN MIAMI — AIR CAPITAL OF THE WORLD

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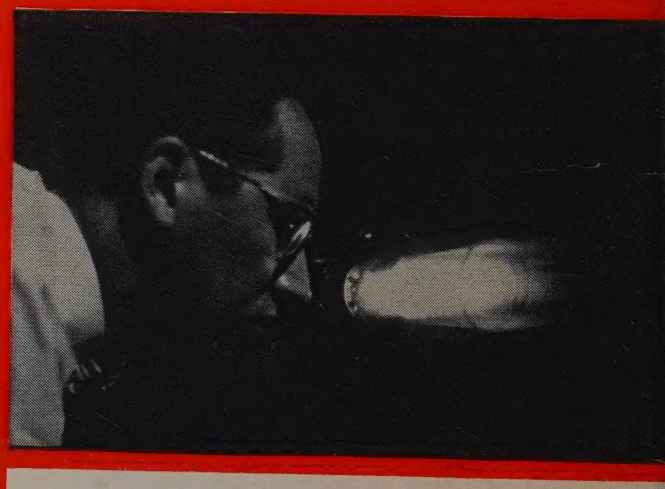
SPECTATOR'S VIEW OF JET PLANE TAKE-OFF

TOO FAST TO FOLLOW



• Socony-Vacuum research engineer studies glass burner simulating combustion in jet engine. Small-scale burners take the place of full-size jet burners —enable researchers to make quick tests under operating conditions. These tests are part of the jet fuel research program Socony-Vacuum is carrying on for the Air Force.

PACING AIR PROGRES

...SO

Socony-Vacuum "flies" at 60,000 feet—makes steep climbs, sets distance records in its test-tube jets. The purpose: to find a jet fuel that eliminates flame-outs and foaming—lengthens flight range.

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SKYWAYS

March, 1952

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Korean battle tests dictate design of a new helicopter

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MARCH 1952 VOLUME 11, NUMBER 3

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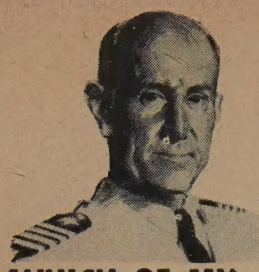
WHAT'S NEW in France is this one-man helicopter, shown here being worn by inventor, Raymond Haussteter of Asnieres, France. This lightweight 'copter (40 pounds) has a bicycle saddle and is strapped to the back of the pilot. In addition to the main rotor there is a secondary rotor (*back*) to combat torque. A one-gallon fuel tank gives the one-man helicopter a two-hour range. Perhaps the age of aerial motorcycles is actually upon us



Captain P. V. H. Weems, U. S. Navy, Retired, founder of Weems System of Navigation, author, internationally known consultant on air and sea navigation.

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AIR WSN WEEMS SEA SYSTEM OF NAVIGATION
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AIR YOUR VIEWS

Kudos

Gentlemen:

I am a new flyer, started my lessons almost a year ago. To supplement my limited-budget flying experience, I have read each issue of SKYWAYS from cover to cover, and I have found flying a plane far exceeds my expectations. In 10 months of flying I have logged about 60 hours. But even with this small amount of flying time, I know I am well ahead of the non-reading flyer, thanks to the informative articles and features you publish. For 25 cents a month I have prevented myself from becoming a "Dilbert" several times since getting my license.

The stories on military aviation are fine, but the type of article I most enjoy and learn the most from is one such as "Bold Pilots Do Grow Old." I am sure there must be many more readers who feel the same way. Some day I want to own a Navion or a Beech Bonanza. So please continue to stress civil planes. Incidentally, your Dilbert cartoons are out of this world!

In closing, would you please comment on the enclosed press release. Would the term "pilot error" apply in this case of the "Connie" landing only half a mile from the Amarillo air terminal even though the instruments indicated fire (which there wasn't)?

D. YOUNG

Los Angeles, Calif.

For our readers' interest, here is the press release: "An airliner, with 56 passengers, made a safe emergency landing at Amarillo, Texas, tonight after barely missing a collision with a speeding freight train. The plane was en route from New York to Los Angeles. The Constellation came down in a field less than half a mile north of the Amarillo Air Terminal. The big plane's nose stopped 50 feet from a railroad track, and about two minutes later the freight sped by. It was not learned immediately why the pilot landed in the field rather than the air terminal. The pilot reported his instruments indicated a fire in the plane. No fire was found after the plane landed . . ." We'd hesitate to call this "pilot error," but then we don't know all the facts either. This may well be one of those borderline cases where, if there had been a fire, the pilot would have been called a hero for getting his ship down and saving passengers' lives . . . or "pilot error" if there'd been a fire and he'd unsuccessfully tried to get back to the air terminal. We'll watch the CAB reports and when this one comes through, we'll pass it on to our readers. Thanks, Mr. Young, for the kind words regarding SKYWAYS. Please be sure we'll keep trying to bring you and our other readers what you want.—ED.

Argument

Gentlemen:

My brother and I were arguing about the needle-like piece of steel coming from the F-84F air intake. He claims that it is radar. I don't agree with him.

B. WHEATON

Verdun, Quebec, Canada

Actually, it is test equipment for the purpose of obtaining certain aerodynamic facts about that particular airplane. Production models of the F-84F are not so equipped.—ED.

Two Opinions

Gentlemen:

I'm perturbed about Frank Harvey's comments in the article "Bold Pilots Do Grow Old." Mr. Harvey speaks of being bold in thick haze. If at 1500 feet the hangars appeared "gray and remote," and at 3,000 feet he experienced the "sensation of being out of touch with the ground," I wonder at what point he thinks he could see an approaching aircraft at closure speeds which would certainly be upwards of 200 mph? That type of flying is hazardous enough off airways, but when practiced with the regularity claimed by the writer over metropolitan areas criss-crossed by myriad airways, it would be suicide. ATC's task of maintaining adequate separation in IFR weather (thick haze to Mr. Harvey) is no easy problem, and one *Cub* staggering around with a low-freq receiver could certainly throw a wrench into the works. This is not meant to belittle little planes. If adequate two-way radio is carried and the pilot can follow instructions precisely, fine!

On the subject of wheel landings, the author states that if you are late in changing stick pressure at the moment you touch down, don't move forward stick then "as you will come back down too abruptly." Nothing could be further from the truth. If back pressure that was being held is not partially released (forward stick, if you want to think of it that way) after a ballooning bounce, the landing gear is going to get one dandy workout from the resulting stalled drop-in.

A. M. HORST

Annville, Pa.

Thanks for your letter, Mr. Horst. For answer, we contacted Mr. Harvey . . . and here's his reply: "Mr. Horst must have been interrupted in his reading of my article at the point of the discussion of haze. I quote from the piece, 'You certainly can't practice in haze except legally when it's above the CAA minimums.' As far as Mr. Horst's comments on wheel landings are concerned, he's making an issue of the difference between 'forward stick' and 'relaxing stick pressure.' Actually, I said this: 'When you do get into a crow hop, it's best to add power, get the airplane flying again, and start over, etc.' If you add power, you do not need forward stick and so Mr. Horst's argument falls apart. When he talks about the work-out the landing gear would get from a stalled drop-in, I say 'Perhaps it depends on airspeed,' but with added power, as I advocated, certainly the plane won't stall out." That's the reply, Mr. Horst. We'll go along with you that it's better to have two-way radio if you intentionally fly the haze, but . . . many a pilot has flown into haze because he's had no warning of it. In that case, it's a darned good idea for a pilot to have had some practice so he won't get panicky and do all the wrong things.—ED.

Operating Costs

Gentlemen:

I have just read the article "Executive Pilot" in the January issue. The story is well written and, of course, we are not at all unhappy that the writer chose the pilot of a Twin-Beech as his subject. However, toward the end of the article, it is stated that "the manufacturer reports the complete hourly operating cost for the "Twin-Beech to be about $68." For the record, and your information, we estimate that the hourly cost of operation of the Model D18S (based on yearly utilization of 600 hours) is $78.10. Prior to this latest figure ($78.10), we reported the hourly cost of operation, at 600 hours per year, to be $82.76 for the D18S.

Again, we assure you of our pleasure at finding an article so favorable to our interests published in your excellent magazine. In view of the assertion, however, that "many claim Beech's estimate is low," we feel it advisable to inform you of our actual published cost figures which we are currently providing our D18S owners.

S. H. HOWBERT

Beech Aircraft Corp.
Wichita, Kansas

Thank you, Mr. Howbert, for setting us straight on the D18S operating cost figures. Judging from the comments of D18S owners who use the Twin-Beech so successfully in business, we're inclined to believe that whatever the hourly operation cost the D18S is worth it in its business usefulness. Congrats on a good executive airplane.—ED.

READY WHEN NEEDED

The GRUMMAN PANTHER is the latest of a long line of Navy Fighters. Like such famous predecessors as the WILDCAT and HELLCAT this fast, rugged turbo-jet was "ready when needed." Since the start of the Korean War it has distinguished itself in combat with Navy and Marine pilots at the controls.

In addition to fighters, Grumman meets our national needs with torpedo-bombers, anti-submarine planes and versatile amphibians.

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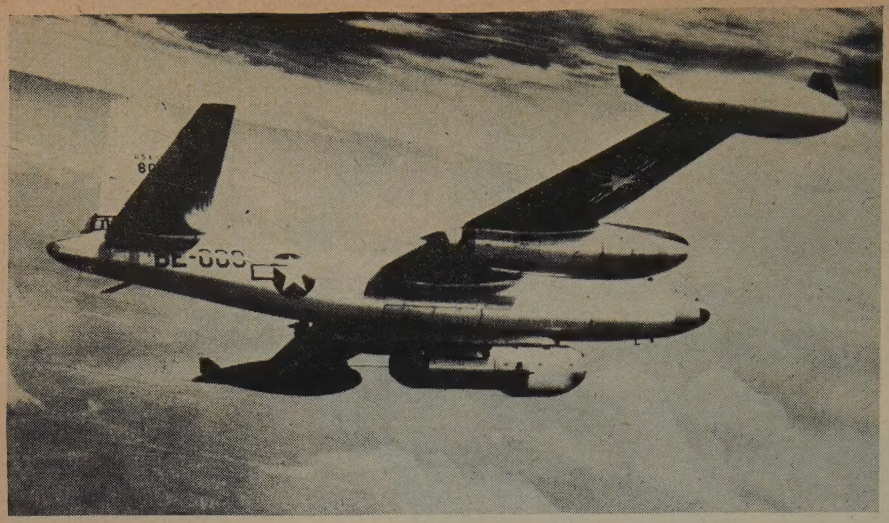

TORNADO, four-jet bomber, is being used by General Electric as "flying lab" for high-speed flight testing of turbojet engines. Note jet engine in nacelle under bomb bay

MILITARY AVIATION

F7U-3 Flight

Chance Vought Aircraft's F7U-3 *Cutlass* recently made its first flight. Designed to outfly and out-fight any other carrier-based fighter in the world, the F7U-3 is a tailless twin-jet larger than its predecessor, the F7U-1, and powered by Westinghouse J-46 engines.

Shooting Edge

A small automatic radar for fighter planes is credited with giving American jet pilots a decided shooting edge over enemy planes in Korea. Built by General Electric, it is the first radar ever to be produced on an assembly-line basis. This radar device eliminates all guesswork on the part of the pilot. It feeds information into a computing gunsight, and if the pilot keeps his enemy on the cross-hairs of this sight, he is assured a hit. Reports from Korea indicate the Russian-built jets have nothing comparable in the way of gun-directing equipment.

Atomic Engine

Pratt & Whitney Aircraft has been awarded an Air Force contract for work on an atomic aircraft engine. Pratt & Whitney will absorb many of the research engineers who worked on the original NEPA project.

Turbo-Rotor 'Copter

Navy BuAer recently disclosed that Kaman Aircraft is flying the world's first turbo-rotor helicopter. Initial flight of this new type helicopter took place in December. Kaman installed 175-hp Boeing gas turbine in a Navy K-225 'copter to conduct a series of flight tests of the new powerplant. Turbine installation is similar to turbo-prop installation. Engineers predict the new helicopter will offer marked increases in performance as compared to the same machine powered by conventional piston engine.

Sweptwing Skyknight

Latest straight-wing jet fighter to get the sweptwing treatment is the F3D night fighter, built by Douglas for the Navy. Designated F3D-3, it will be powered by the new J-46 jet engine, will have sweptback wing and tail surfaces.

C-97 Drop Plane

Tests are being made with the C-97 in the role of drop plane, parachuting supplies to troops in forward areas. Already a troop transport, hospital plane and air freighter, the C-97 tests thus far have proved it can haul and drop helicopters, howitzers, bulldozers, etc., to troops in the field.

Turbo-Prop Constellation

The Navy's R70-1 *Super Constellation* is going to get new powerplants early in 1953, According to late reports, the Lockheed cargo plane will be equipped with Pratt & Whitney T-34 *Turbo-Wasp* engines. These new engines will give the R70 a cruising speed of about 400 mph at 25,000 feet while hauling a payload of 35,000 pounds. Installation of new engines is being held up until 1953 so as not to disturb present production schedules of the "Super Connie" with the Wright compound piston engines.

Jet-Propelled Laboratory

Newest "flying laboratory" for flight testing equipment is the four-jet North American B-45, assigned to General Electric by the USAF. Called the first jet-propelled lab, the B-45 features an especially designed nacelle, partially retractable when not in use, under the bomb-bay. This nacelle will accommodate turbojet engines considerably larger than any yet announced. The plane has been equipped with hundreds of special instruments which will record every phase of the test engine's performance in flight. Among the turbojets to be flight tested are GE's powerful J-73 and the J-47-GE-17.

News Notes

NORTH AMERICAN has begun pre-flight work on Air Force F-86D *Sabre* jet all-weather interceptors in two new hangars at the Los Angeles International Airport.

HELICOPTER Industry was awarded the Collier Trophy. President Truman presented the trophy to Igor Sikorsky in honor of the helicopter industry, in ceremonies at the White House.

ROYAL CANADIAN AIR FORCE version of the *Sabre*, being built by Canadair, has been named the *Star*.

KAMAN helicopter, Navy's K-225, is powered by Boeing 502-2 gas turbine. Pilot at controls on the gas-turbine powered 'copter's first flight is Flight Test Chief W. Murray

When calls came for tactical air support in Korea, the day after hostilities started, Douglas-built AD4 Skyraiders were on the job. From their battle stations on U.S. carriers, they flew into combat against North Korean ground troops.

Ready in quantity to meet the immediate need—with versatility to serve as day or night bombers, aircraft early warning, or for anti-submarine work... that's the Skyraider story.

Now in production at Douglas is an even more versatile member of the AD series. It's the AD5, which can be modified for use as a 6-place transport, 12-place evacuation ship, photographic plane, litter carrier, long-range bomber, attack bomber, or radar-equipped "eyes of the fleet."

Because it *does* take both time and money to produce good airplanes, Douglas works far ahead on design and development so when the call to battle stations comes, the planes will be there. Douglas Aircraft Company, Inc.

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SUPERFORT gets a pre-flight check in early morning fog just prior to take-off on routine mission from March AFB

Bomber crew gives abortive flight routine handling to safe landing

Flight Crew Is Ready

By DON DOWNIE

What is the one flight a pilot remembers most clearly? You can bet it wasn't routine! The most vivid memories of big airplane pilots are almost always those 10-minute up-and-around-the-pattern affairs where something went wrong.

Pay-off for the endless hours spent in simulated emergency procedure in today's big airplanes seldom makes a headline. When a four-engined bomber with one propeller feathered comes back safely, there's no news story. When a big transport with a stuck landing gear turns around and gets back in, it's expert flight training that makes the emergency seem routine.

These memorable short flights where "something happens" on take-off or shortly thereafter are called "aborts," abortive flights. When such comes along, the crewmen put into actual practice the lengthy

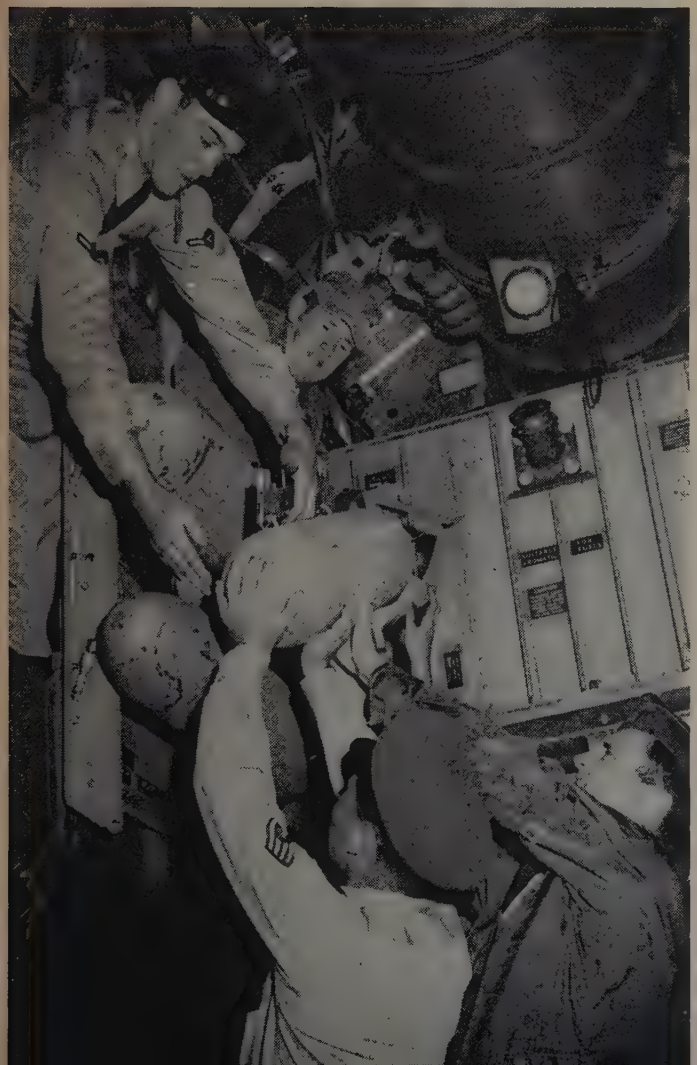
BOMBER CREW lines up in front of the B-29 for its pre-flight briefing. Short time later this *Superfortress* "aborted"

MECHANICS pour over the engine that caused the B-29 crew to put into actual practice the B-29 emergency procedure

training in simulated emergencies that goes into every flight check for military aircraft commanders or airline captains. When there's no big black headline, the credit goes to a sharp flight crew that learned well the lessons of emergency procedure.

A typical "abort" may happen like this one did recently. A B-29 from the 15th Air Force (part of the Strategic Air Command) took off from the March AF Base near Riverside, California, on a routine training mission to drop 15 practice bombs on the Sahaurita bombing range near Tuscon, Arizona. The

FLIGHT ENGINEER aboard the *Superfortress* was M/Sgt Haeschel Blackwell of Houston, Texas, shown here at controls



mission was scheduled to take 12 hours in the air. Day and night celestial navigation were to be practiced en route. But the mission didn't work out that way.

Everything went according to plan until the landing gear started up on the B-29 after take-off. Aboard were 10 regular crewmen and your SKYWAYS correspondent. Just as everyone began to set-

AIRMEN hand up practice bombs that were to be used by the B-29 on the training mission that wasn't completed

AIRCRAFT COMMANDER aboard the *Superfortress* was Lt. George F. Kush of Englewood, N. J., here at controls

CO-PILOT was Lt. Clyde R. Denniston Jr., a West Point graduate. Landing weight of the B-29 was 120,000 pounds

tle down for the long hop, a voice over the inter-com system snapped us up.

"A/C from Left Scanner, there's a little smoke coming out of number one nacelle, sir." (A scanner is actually a gunner, despite current usage.)

"There's black smoke from the top cowl flap of number one," said the Navigator as he peered through the small window beside his seat.

"Do you see any flame?" asked the pilot without taking his eyes off the instrument panel.

"No flame from the front," continued the Navigator, Captain Raymond H. Stocks of Martinsville, Virginia.

"A/C from Flight Engineer, oil pressure normal on number one. No fire warning lights, sir," followed M/Sgt. Heaschel Blackwell of Houston, Texas.

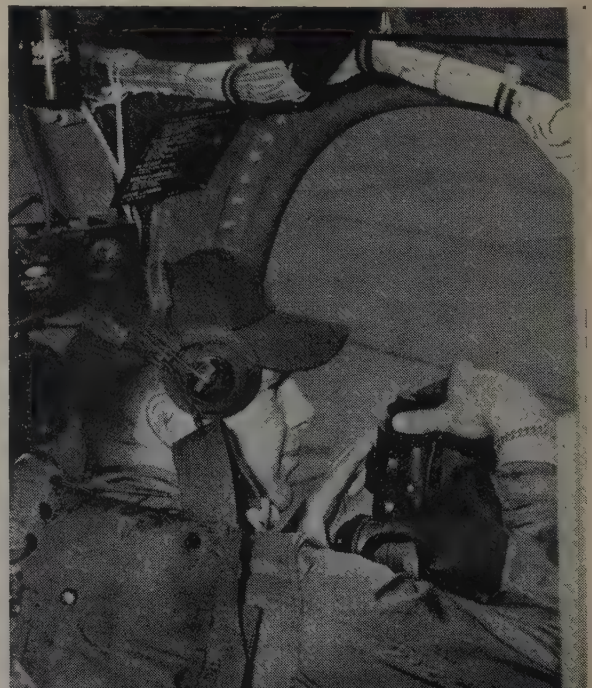
"Advise the tower that we're remaining contact and circling back over the field, but don't declare an emergency," said the A/C (Aircraft Commander) Lt. George F. Kusch of Englewood, New Jersey.

The co-pilot, West Point graduate Lt. Clyde R. Denniston Jr., snapped the selection switch on his radio jack-box and talked quietly into his throat mike. No one showed as much as a drop of perspiration, that is, no one of the regular flight crew. I can't vouche for me.

The sky in front of the Bombardier, Lt. Willard Beadel of Glendale, Cali- (*Continued on page 42*)

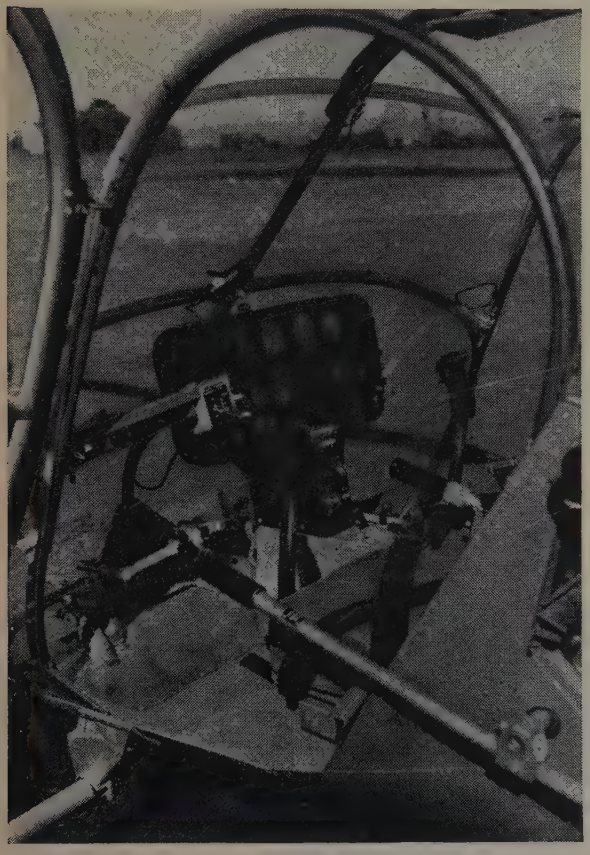
NAVIGATOR for the mission was Capt. Raymond H. Stocks of Martinsville, Virginia. He watched smoking engine

SCANNER who spotted black smoke pouring from engine was Cpl. C. E. Hall Jr., New Brighton, Pa. Scanner is a gunner



ARMY'S NEW H-23B offers more power than its predecessor, H-23A. Many engineering changes contribute to easier maintenance. Note wide tread of new skid landing gear. H-23B is built by Hiller Helicopters at Palo Alto, Calif.

COCKPIT of the H-23B features improvements that add to pilot comfort. Cockpit is wider, roomier than that of H-23A



ARMY H-23B

Hiller's latest 'copter, the H-23B, may wear the "old look," but it's a new design nevertheless. All in all, 54 major engineering improvements are incorporated in the H-23B, the result of in-battle experience in Korea.

In the fall of 1950, after a few Marine helicopters had shown their unique ability in Korea, various Govt agencies began to search the field for production capacity. Only four manufacturers had reached the stage of quantity manufacture of helicopters for military use. Hiller Helicopters was one of the four. To fulfill the immediate requirements, Hiller converted its Hiller 360; it became HTE-1 for the Navy and H-23A for the Army. The conversion included installation of such equipment as extra radio, floor stick and special electronic equipment. When these 'copters were pressed into service in Korea, it soon became apparent that the civilian electronic equipment, instruments, etc., could not stand up under the pressure of military operation.

To correct this situation, an engineering conference was held at Hiller Helicopters, and all the suggestions from the field were incorporated in an entirely new helicopter design: the H-23B.

New transmission, new body, new tail section, completely new electronic system, new controls, new cockpit enclosure, a new skid gear and a larger 200-hp engine are just a few of the improvements built into the Army's H-23B 'copter now coming off production lines at Hiller.

The new H-23B has a useful load of 744 pounds, a gross weight of 2500 pounds. It is powered by Franklin 6V4-200-C33 engine, offering 200 hp at 3100 rpm at sea level.

Plane Proximity Warning

Flying in fog, clouds, or toward the sun on a hazy day makes a pilot apprehensive. He can't help but wonder—and in many instances worry—about what's ahead. It's always a more relaxed situation at the controls when the view ahead is unhampered.

In poor visibility flights today, it's easy to say, "Why worry? I'm at the proper altitude for my course. Chances are greater than a thousand to one there's no plane on the other side coming in my direction—and the odds are even greater that if there is, it is not at my altitude."

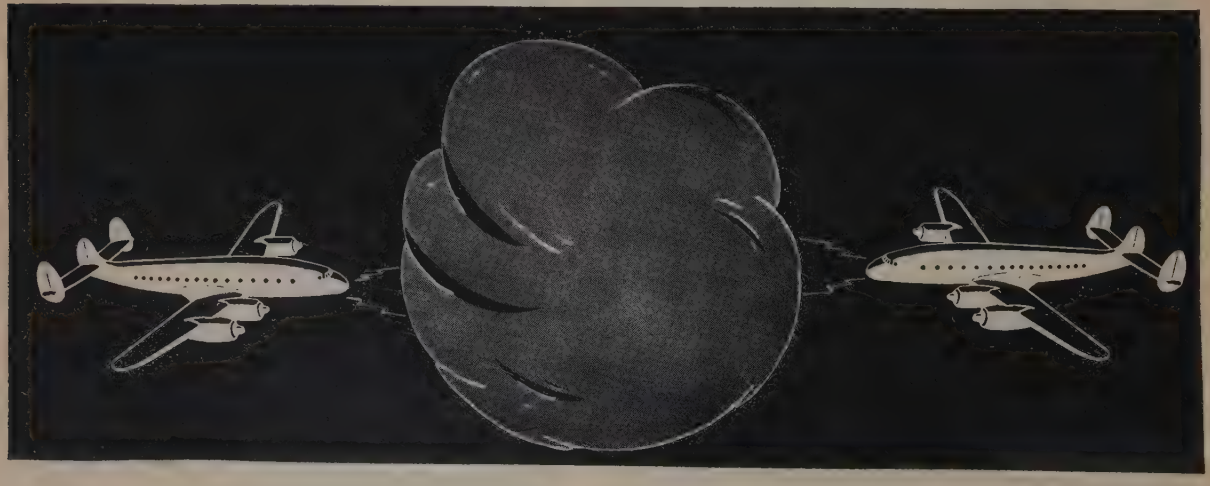
This is the only philosophy a pilot can now take in such situations. In most cases he gets through in good shape. But aviation history on mid-air crashes reveals that a number haven't. Collisions in the sky have occurred on the best of flying days when perhaps that turn into the sun was made at just the wrong time. Growing air traffic—military, commercial and private—is continually increasing this danger.

Remember that private plane that crashed into the overseas transport over Long Island a few years back? Luckily, the airliner got down safely, but the private pilot and his passenger were killed. A similar collision over New Jersey between a military plane and a commercial transport was much more

By BUD BAER

INVENTOR Charles Adler Jr. gave patent for Aircraft Proximity Indicator to the CAA. He also invented two-circuit position lights

CLOUDS sometimes are loaded, if not with rocky mountains perhaps with another airplane. The API is a safeguard to warn planes on a collision course of the exact location of each other. Vital item: UHF periodic impulses



AIRCRAFT equipped with API would carry microwave or UHF transmitters which would beam out periodic impulses in all directions within 20-mile radius during flight. Impulses would be warning signals to alter direction to right

disastrous. And there are a number of other such incidents on recent records.

There is one pilot who has believed for a long time that it would be a great step in aviation safety if this anxiety of wondering what's ahead could be eliminated. This pilot—Charles Adler, Jr., of Baltimore, Maryland—realized this more than ever following an experience in the crowded sky above Baltimore.

"I was piloting my Temco *Swift* on a clear, sunny day, but the very presence of the sun limited my visibility—the rays were shining directly into the windshield," he related. "Suddenly, I sighted a DC-4 airliner heading in my direction. The transport was so close that only by diving under it did I escape being hit."

This experience of Adler's is not uncommon among pilots. The only difference is that Adler thought seriously about doing something about this hazardous flying situation. He was able to do so, too, because he is not only a pilot but also an inventor, specializing in electronics.

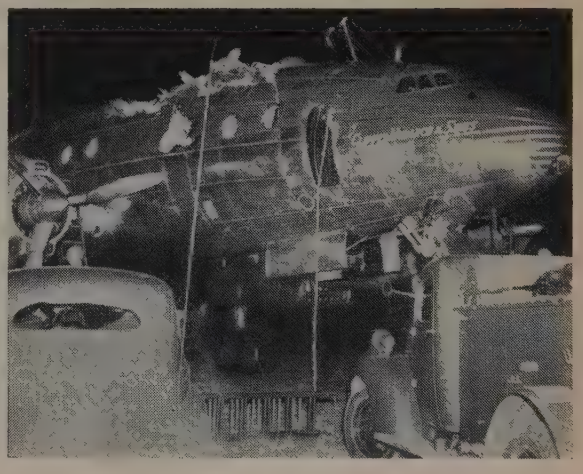
Adler, the inventor, figured out a simple but far-reaching way that the hazards from mid-air collisions could be greatly reduced. When he gave his patent (No. 2,560,265) to the Civil Aeronautics Administration last August, he may have taken the initial step in the eventual elimination of one of the big worries of today's pilots—what's ahead.

Patent number 2,560,265 covers a device known as the Aircraft Proximity Indicator (API). It is designed to advise pilots in flight, day or night and in any kind of weather, when the location of their aircraft with respect to others in the sky presents the possibility of a mid-air collision. If all aircraft were equipped with Adler's device that warns pilots of the nearness of other aircraft, mid-air collisions might just not happen any more.

Adler's system would require that all aircraft carry microwave or ultra high frequency transmitters which would beam out periodic impulses in all directions within a 20-mile radius during flights. Such a transmitter on an aircraft would be connected with an omni-directional vertical antenna, mounted on the top or bottom of the fuselage. These impulses would be warning signals to other aircraft in the immediate area if the respective aircraft are flying collision courses. The beams would share the pilots' worries.

To receive these warning signals, all aircraft also would have to have two receivers to provide receptive coverage in the danger areas ahead and to the sides of each aircraft. These two reecivers in an airplane would be connected by co-axial cable or other suitable means to electro-magnetic horn antennae placed one on each side within the nose of the aircraft. Or the external co-linear antennae could be used instead of the horn antennae, thereby simplifying the antennae (*Continued on page 44*)

AIRLINER was struck in flight by lightplane. Such mid-air accidents would be eliminated by Charles Adler's API



This Is Your Flight Engineer

Third man in the cockpit is one of the most important: he sees to efficient operation of "10,000 horses"

FLIGHT ENGINEER, in this case F/E R. Bartlett, checks hydraulic lines to the landing gear prior to take-off

By V. S. HOFFSTROM

TRANS-WORLD AIRLINE pioneered use of flight engineers on its planes. Flight-engineers training program was established early in 1940; first graduates went out on Boeing *Stratoliners.* Now every "Connie" has flight engineer

HYDRAULIC LINE check begins at outer hub of *Constellation's* landing gear. This is just one of F/E's chores

PROPELLERS on the "Connie" are checked for nicks and ridges, and prop's de-icer shoe gets a thorough check

He's a very useful fellow—and his crewmates know it. That's the Trans World Airlines flight engineer, third man in the cockpit of every *Constellation*. Providing another arm for the pilot and co-pilot, another set of eyes and ears, he sees to the operation of the plane's "10,000 horses."

The flight engineer came into being when airplanes became bigger and more specialized. Flying large multi-engined transport aircraft is not just a one- or even two-man job; it takes a trio of experts working together as a unit on the flight control deck.

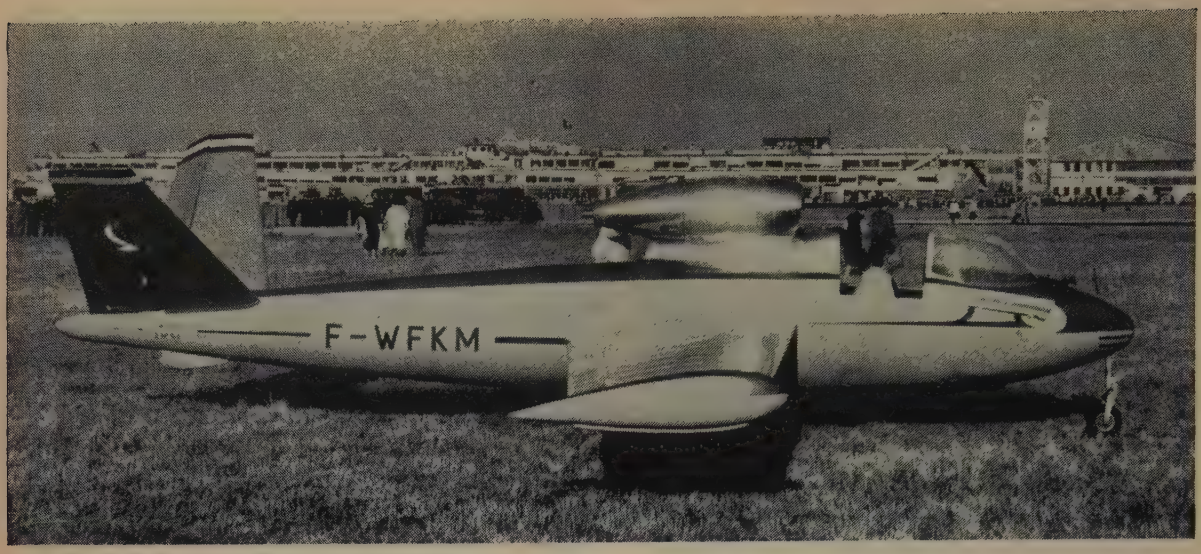
Recognizing the need for another man on the flight team, TWA pioneered in flight-engineer development by establishing a training program early in 1940. A few months later, when the first graduates went out on the Boeing *Stratoliners* then being flown by the company, TWA became the first airline to use flight engineers on domestic runs.

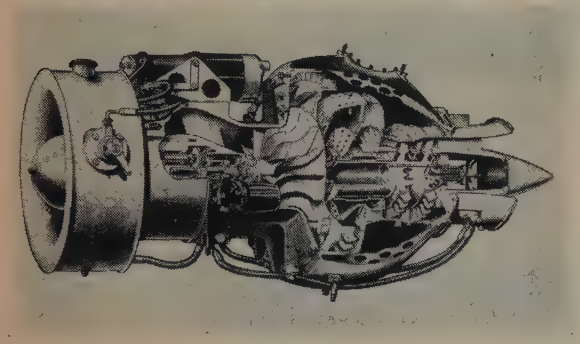
Not until May, 1947, did any other airline use them domestically, and not until December, 1948, were they made compulsory, by a CAB ruling, crew members on four-engine equipment.

What, exactly, is a good flight-engineer's job? According to R. L. Proctor, manager of TWA flight engineers, he must be more than an expert mechanic; he must be a technician, a coordinator, an expediter and even a diplomat. And when he's working a flight, Mr. Proctor adds, "he must properly blend together those qualities for the successful execution of his duties." (*Continued on page 52*)

FUEL carried aboard the *Constellation* comes in for a double-check, as does the oil for big ship's engines

FLIGHT ENGINEER, shown here at his cockpit station aboard the "Connie," controls 63 per cent of all gages





FOUGA CYCLOPE 11 was developed from earlier *Sylph*. It is powered by a Turboméca *Palas (left)* turbojet giving 330 pounds thrust for take-off and affording a maximum speed of 217 mph. The *Cyclope*'s range is about 187 miles

France designs jet lightplanes while U.S. plane builders think about it

By WILLIAM GREEN

France Builds JET PERSONAL PLANES

The French airplane designer's ingenuity is almost traditional, and his love of "gadgetry" is characteristic, France having always been the happy hunting ground of the individualist. French lightplane designers may lack capital but they certainly do not lack ideas. Even so, never has the technical interest of the world's lightplane owners been more thoroughly whetted than it has been by the light jet airplanes that are to be seen in French skies these days.

Representing the most important and radical advance in personal flying for two decades, such machines are, at the present time, looked upon in the United States as little more than a roseate pipe dream, but they are no longer a pipe dream to the French who, despite their post-war difficulties, are very much in the forefront of adapting the gas turbine to the needs of the lightplane owner.

The debut of these turbine-powered lightplanes, already exciting the admiration of American pilots, denotes the beginning of a change in the whole concept of small-plane design and operation. Of course, the changeover from the pounding pistons to the gas turbine will not come about in any overnight revolution, but it should not be long before lightplane pilots will be dropping in at airports and, instead of asking for high-octane gasoline, will say, "Fill 'er up with kerosene."

The fantastic progress that has been made in the art of jet propulsion under the impetus of seemingly insatiable military demands is a fact of which we are all aware, as is the fact that turbine-powered commercial transports will soon be seen on scheduled runs, but until recently this new technology did not seem likely to mean much to the personal owner in the foreseeable future.

However, the brilliant designs of Monsieur Szydlowski, the chief engineer of the Turboméca company of Bordes, France, suddenly changed the picture and brought the jet lightplane half-a-decade nearer to the personal owner's grasp. Fortunately, French progress has not escaped the notice of one or two enterprising American companies: the manufacturing rights of nine Turboméca gas turbines

have been bought by the Continental Motors Corporation of Detroit, and the Stratos Division of the Fairchild Engine and Airplane Corporation are also to build a Turboméca unit.

Pessimists have repeatedly argued that turbojets are of little use for speeds much below 500 mph. Although it is to be admitted that such arguments are well-founded, the performances achieved by French lightplanes powered by small turbojets have confounded those who thought the poor efficiency of the pure jet at low speeds would be unacceptable. Many American authorities consider that the only answer to this poor propulsive efficiency of the turbojet operating at speeds normally associated with light airplanes is to absorb most of the unit's energy in another turbine wheel driving a conventional propeller, *i.e.*, the turboprop. For those who still adhere to this view, Turboméca has produced two small turboprops and has also built ducted-fan units, the characteristics of which lie more or less midway between the pure turbojet and the turboprop.

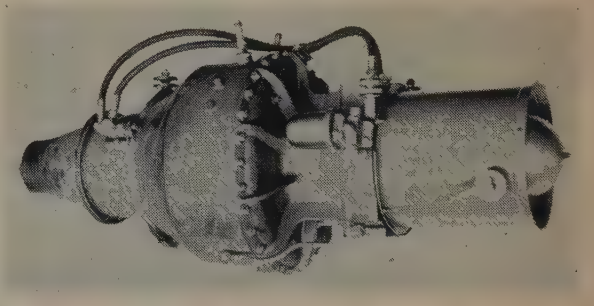
True, such units are expensive—a price of around $4200 having been mentioned for the 220 pound thrust *Piméné*, but these turbojets are virtually hand-built and the position will alter rapidly when they reach quantity and assembly-line production.

The Turboméca range of small gas turbines for small planes is extensive. All possess the same basic design features, having two centrifugal compressors, two-stage diffusers and single-stage turbines, and demonstrate the possibilities of perfecting a simple design and then scaling it up. The range of units includes the 220-pound thrust *Piméné*, the 330-pound thrust *Palas*, the *Marboré I* and *II* of 660 and 840 pounds thrust respectively, and the 485 and 727-pound thrust *Aspin I* and *II* ducted-fan units, having a secondary, or by-passed, airflow and consequently improved propulsive efficiency at low speeds. Closely related to these units are the two turboprops, the *Orédon* and the *Artouste*, the former developing 160 equivalent shaft horsepower and the latter, 280 eshp.

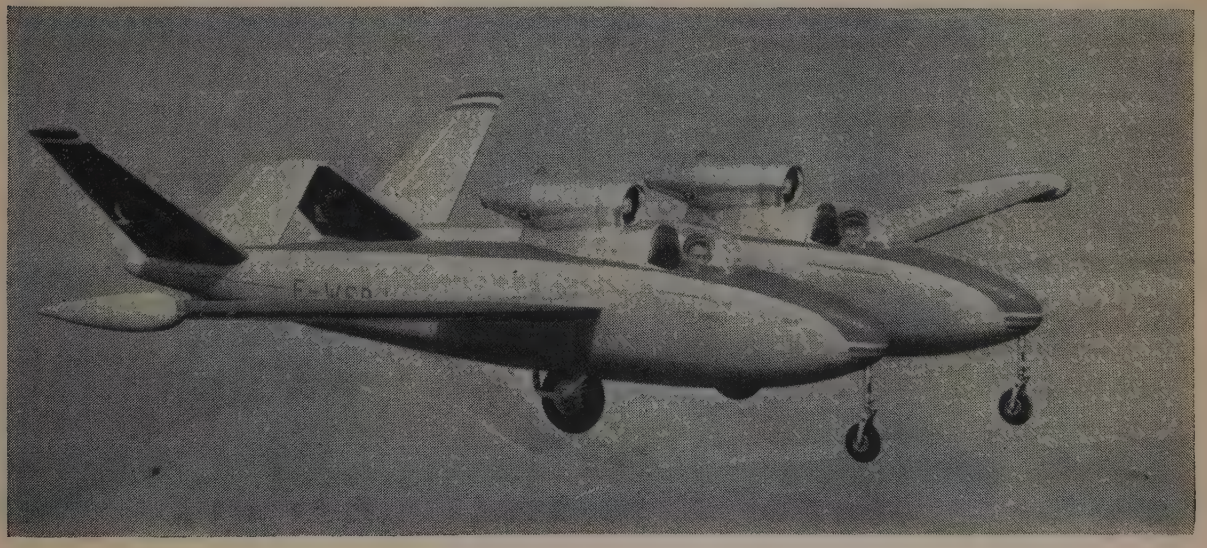
The first plane to be powered by a Turboméca unit was the Fouga C. M. 8R-13 *Sylph*, which caused a sensation when it first appeared in 1949 at the Paris International Aeronautical Exhibition. Produced by Fouga et Cie., of Air-sur-l'Adour, and designed by Robert Castello and Pierre Mauboussin, the *Sylph* looks like a power-assisted sailplane and many have mistaken it for that. Indeed, it *was* developed from the C. M. 8 sailplane but is, in fact, a fully aerobatic, high-performance single-seat sport plane.

Initially, the idea behind building the *Sylph* was to provide an airplane for weather research at high altitudes and, simultaneously, a flying test-bed for the *Piméné* turbojet. But so successful were flight trials that the machine's potentialities as a fast sport plane were immediately envisaged.

The *Sylph* itself has many sailplane characteristics; its high aspect ratio wing (13:1) spans 42 feet 6 inches and its fuselage length is 21 feet 7 inches. The wing flaps are conventional but an unusual system of air spoilers is used, taking the form of perforated (*Continued on page 56*)



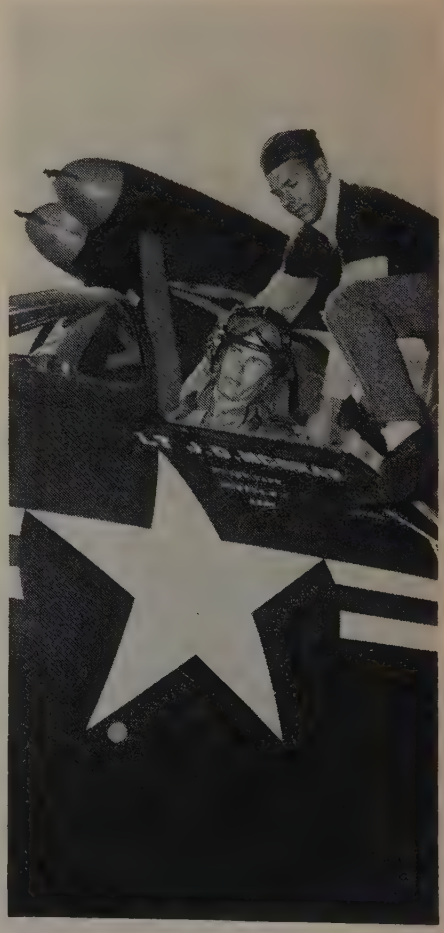
FOUGA GEMEAUX is a two-place personal plane *(below)* powered by two Turbomèca *Piméné* turbojets *(right)*, each unit giving 220 pounds thrust for take-off. Bare weight of the unit is 92 pounds. *Gemeaux* has top speed of 205 mph



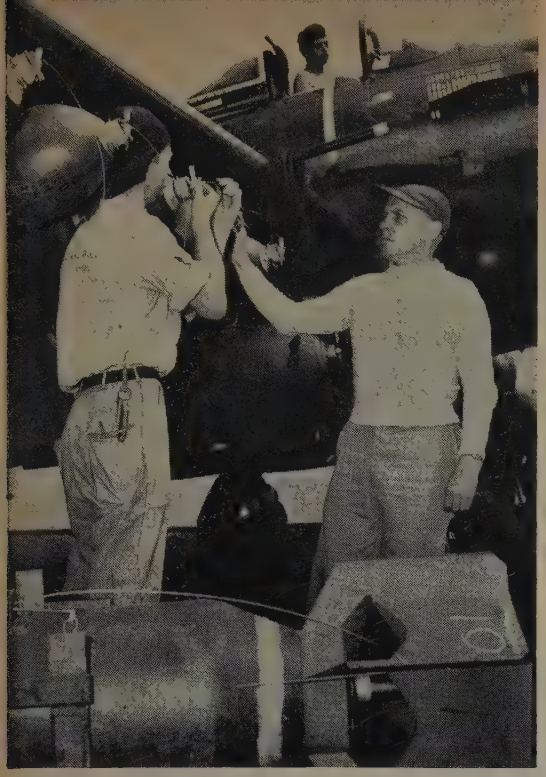
CREWMEN service *Panthers*, readying them for another strike in Korea

CARRIER AIR GROUP 101 aboard the *USS Boxer* await the "man your jets" call in the ready room. Group 101 recently was relieved in Korea by Reserve 15

MISSION coming up, Lt. J. McGraw is pinned into plane by John T. Gunn



Full-Time Fighters



SAFETY WIRE is placed on bomb fuse during arming operations aboard the *USS Princeton*

BANSHEE pilots return to carrier *USS Essex* after strike against Communists in North Korea. Many Navy airmen are recalled Reserve officers

Flying alongside regular Navy airman are Reserves doing full-time job

By M. C. ROACH

The air groups aboard the aircraft carriers *Essex* and *Antietam* had been preparing for this attack for a week. The target was a munitions manufacturing center neatly tucked away in a narrow, well-guarded mountain stronghold just west of Shusen.

Enemy guns defied the 50-plane combined carrier assault and poured out heavy flak and small arms fire. *Corsair* and *Panther* jet pilots went in first, hitting the anti-aircraft with rockets and 20-mm fire and paving the way for the *Skyraider* dive-bombers and their 2,000 pounders. Enemy war materials were stockpiled, making perfect targets for napalm and fragmentation bombs. More than 60 buildings were destroyed and another 20 were damaged. Secondary explosions did a lot of damage when munitions in the buildings went sky high.

"It was the most intense flak we've encountered over Korea," declared the air group commander, "but thanks to the wonderful job done by the jets and *Corsairs* on the enemy guns, all our boys got back."

Carrier Air Group Five based aboard the *Essex* is composed of regular Navy squadrons. Flying right beside the regulars are the ex-"Weekend Warriors" of Naval Air Reserve, now operating from the *USS Antietam* as Carrier Air Group 15, with Lt. John Barteluce of Maywood, N. J. leading the New York jets, Lt. Comdr. Bob Doering of Denver, Colo., skipper of the Denver *Corsair* flyers, and Lt. Comdr. Soule T. Bitting of Arlington Heights, Ill., commanding the Chicago *Skyraider* group.

What used to be part-time weekend training at the Naval Air Reserve Stations at New York, Denver and Glenview has turned into a full-time job for Barteluce, Doering, Bitting and their fellow fighters.

During the month of June, 1951, almost every third American airplane that flew over Korea on a combat mission was in the hands of an activated Naval or Marine Air Reservist. Carrier Air Group 101, the first Reserve group to enter the Korean war, was operating from the *USS Boxer*. Half the pilots aboard the *USS Princeton* were recalled Naval Air Reservists. All the pilots of Carrier Air Group 102, based aboard the *USS Bon Homme Richard*, were former "Weekend Warriors," and 50 per cent of the patrol squadrons in the combat theatre were activated Reserve patrol squadrons.

Upon completion of their seven-months combat tour, the *Boxer* Reservists were relieved by the *USS Antietam* and her CAG 15. The *Princeton* returned home in August. These Reservists have since been assigned to shore stations (*Continued on page 45*)

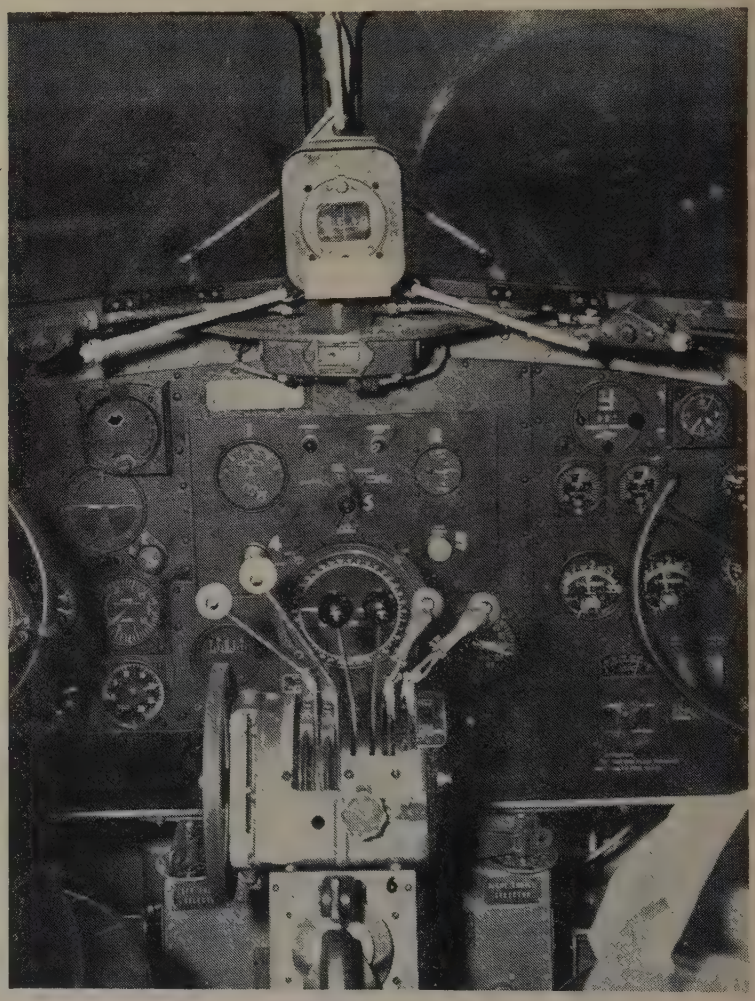
EXECUTIVE AIRCRAFT, such as this Chase National DC-3, carry extensive radio equipment for added usefulness

Equipment Adds Utility

Aircraft used for business require flight navigation instruments and radio devices that assure utility

By A. J. BOTENS

Eclipse-Pioneer Div. Bendix Aviation



PB-10 FPC components are: (1) Master Direction, (2) Pitch Trim Indicators, (3) Sequencing Switch, (4) Clutch Switch, (5) Beacon light

An executive airplane provides a mode of travel to busy men of the business world that cannot be equalled with respect to speed, comfort, luxury, privacy and safety.

Typical of the many corporations whose executives fly extensively in their own aircraft is General Motors Corporation. Monthly meetings, attended by all the high-ranking executives and production officials, are held in New York City. Use of GM's own planes assures flexible and economic transportation for these men of industry who now need not waste valuable time adjusting their working hours to meet public-transportation schedules. There is no rush to conclude a meeting when the time for scheduled departures of commercial carriers arrives. Instead, the concluding hour of the meeting is the scheduled time of departure.

To the cost-conscious executive it can be said that the operation is extremely economical considering the hundreds of thousands of miles flown in every business year, and the ability to travel anytime or any place as immediate conditions dictate. It would cost no more to transport a half-dozen men in a DC-3 from coast to coast between daylight and dark than it would cost for the same men traveling on their own for several days along the same route by rail.

For the executive who is partially disposed toward adopting for his company's travel needs executive-type aircraft, some consideration of related operational and maintenance techniques is in order. The first step is to choose an airplane and then to select the equipment with which it is to be furnished. In the order of things, step number two necessitates finding a crew to fly and maintain the airplane, and then locating a suitable operational base.

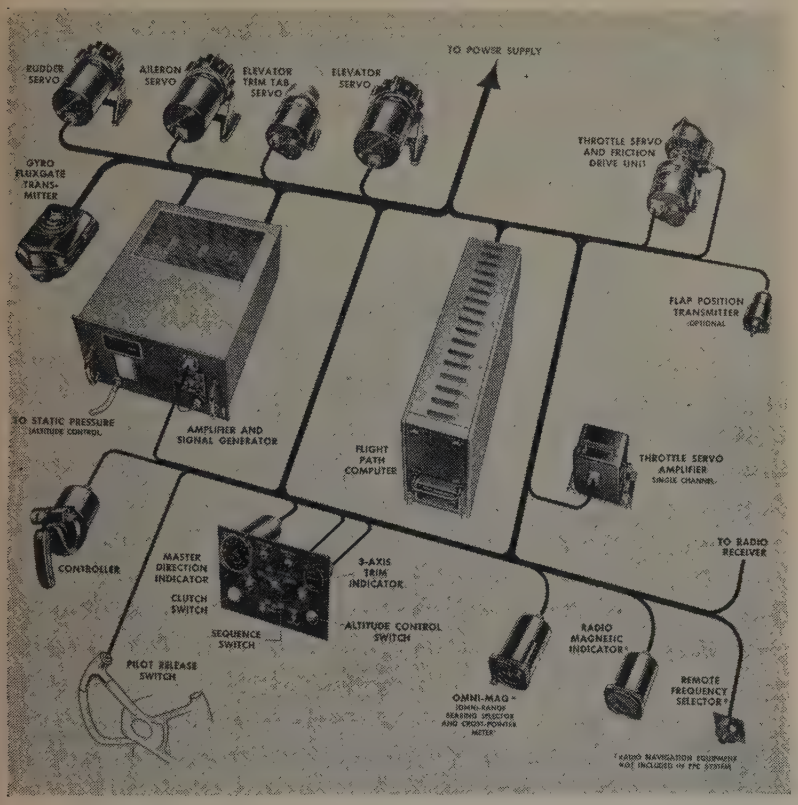
Selection of the airplane is dictated by its anticipated use, estimated hours to be flown a year, distances to be covered, operational speeds required, the average number of passengers to be flown and facilities to be provided for flight comfort.

The airplane for the individual executive might be a small, four-place *Navion* or Beach *Bonanza* selected with respect to economy of operation, reliability and range. These two small, compact ships are well suited for short hops, yet sufficient space is available to carry considerable luggage and additional personnel.

The top-flight executive whose needs demand considerable space may require a twin-engine DC-3. With a much greater range and an enviable reputation for reliability, it affords spacious accommodations whereby an entire staff might be flown on important trips.

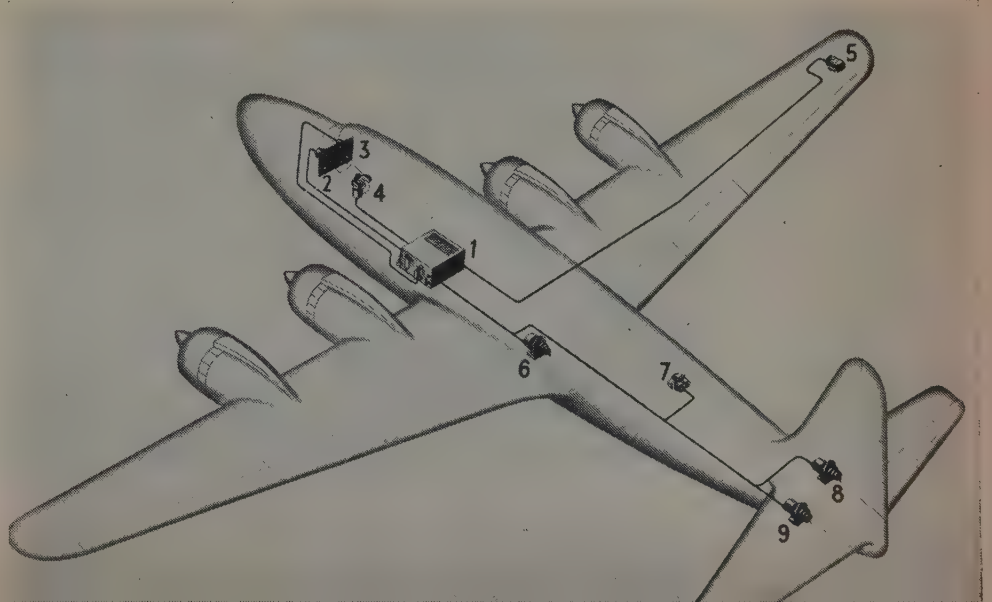
Variations in conditions thus dictate the needs for particular airplanes as indicated by the variety of executive ships in use: Douglas DC-3, DC-4, Lockheed *Lodestar*, Consolidated PB4 *Catalina*, Grumman *Widgeon*, *Goose* and *Mallard*, the Twin-Beech and a host of others.

Selection of a crew is similar to the selection of an airplane. Where a smaller aircraft, *i.e. Navion* or *Bonanza*, is involved, it is often-



COMPLETE PB-10 Flight Path Control system includes Omni-Mag (Omni-range bearing selector and cross-pointer meter) and radio magnetic indicators. The radio magnetic indicator provides same information as ADF. The PB-10 weighs little over 100 pounds.

COMPONENT arrangement of PB-10 installation are: (1) Amplifier, Signal Generator, (2) Pitch Trim Indicator, (3) Master Direction Indicator, (4) Controller, (5) a Fluxgate Transmitter, (6) Aileron, (7) Trim Tab, (8) Rudder and (9) Elevator Servos.



times piloted by the owner-executive. Maintenance on a plane of this type is similar to the maintenance of an automobile, with service provided by a line crew, and periodic inspections done at competent inspection and overhaul depots.

Where the larger type plane is involved and greater flying time logged, the problem is somewhat different. A flight crew is a must and usually consists of a pilot with an ATR (usually an ex-airline pilot with experience numbering tens of thousands of hours), and a co-pilot/mechanic. The latter probably holds a commercial ticket and an A&E license. He will handle all the routine inspections and required line maintenance. For relicensing, required once a year, an additional mechanic's services will be needed. The co-pilot/mechanic accompanies the pilot on all trips.

CONVERSION of multi-engine aircraft for corporation use requires installation of flight, radio equipment comparable to that of airlines

Airports throughout the country are reasonably well-equipped with reliable operators who provide excellent hangar and basing facilities. Typical of such operators are Mallard Air Service at Teterboro, N. J., Pacific Airmotive in California, Southwest Airmotive and Spartan Aero Repair in Texas and Oklahoma respectively. Monthly rental fees include space and such service as washing, cleaning and vacuuming the interior. Gasoline and oil is often handled through a credit-card system, payable monthly.

A look at the executive planes at almost any airport proves that owners are extremely equipment conscious. By the very nature of their use, such planes must be equipped with flight navigation instruments and radio devices. A surprisingly large number carry automatic pilot installations which provide smooth and dead-beat cross-country flying, at the same time minimizing pilot fatigue.

Standard practice in the procurement of new aircraft by a corporation is to purchase them with the equipment the manufacturer elects to install in them and then to make additions as dictated by operating conditions and the recommendations of the pilots and mechanics.

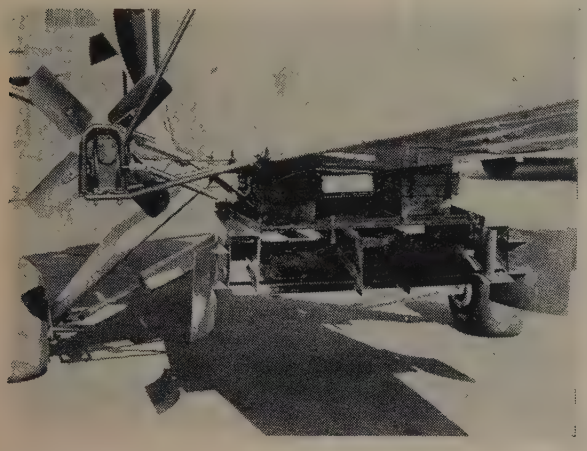
Typical of the occurrences which prompt the additions of equipment to corporation airplanes is the case of a busy executive who was on a business trip and scheduled to attend an important conference. As luck would have (*Continued on page 46*)

AIRCRAFT used for business are not fair-weather planes. They must be and are equipped for instrument conditions

Piper Spray Plane

Duster/spray plane for farmers developed from Piper Super Cub

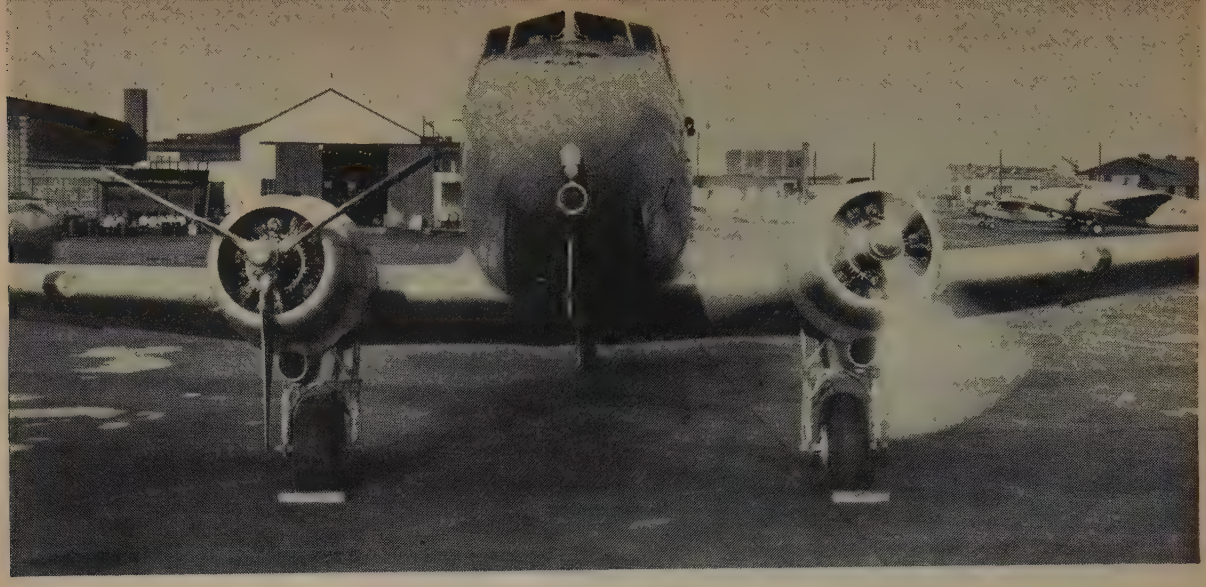
BOOMS on new Piper spray plane are built to swing back if hit. This prevents damage to dispersal unit and plane



VENTURI, double-gated, with lateral flow dispersal plates, flaps, gives deep penetrating coverage in wide dust swath

ACCORDING to a late census, there are about six million farms in the United States. It isn't hard, therefore, to appreciate the importance of the airplane, particularly the crop duster plane, to the agricultural side of our economy. For the past three years Piper Aircraft Corporation, aware of the need of an airplane specifically designed for crop dusting and spraying, has done development work in this agricultural field. Out of its work has come the PA-18-A, specifically built for aerial application of agricultural chemicals. Developed from the basic Piper *Super Cub* 125-hp general utility plane, the PA-18-A can handle very heavy loads and can take off and land in less than five lengths of its own fuselage. As a duster plane, the PA-18-A can handle a volume of 18 cubic feet of dust or, as a spray plane, an effective capacity of 110 gallons. To give the airplane an "extra" in utility, the tank for dust or liquid can be easily removed to permit hauling of freight or cargo. For spraying, the PA-18-A has two streamlined booms under each wing, each containing 12 spray nozzles. The total of 24 nozzles puts out a swath over 50 feet wide, and dispersal can be adjusted for coverage of from one-half to five gallons per acre. As a duster, the plane can spread the dust over a swath nearly as wide as with liquid, and the extended flaps provide a good penetrating down wash.

PIPER PA-18-A, following three years of development, has been put into production as economical crop duster, sprayer



SLUDGE DEPOSITS in the propeller dome can be cleared out by the periodic practice feathering of the airplane's two props

PROP BLADES that have pits, nicks may be reworked by removing sufficient material to eliminate irregularities. Be sure to keep blade contour the same *(See diagram, page 28)*

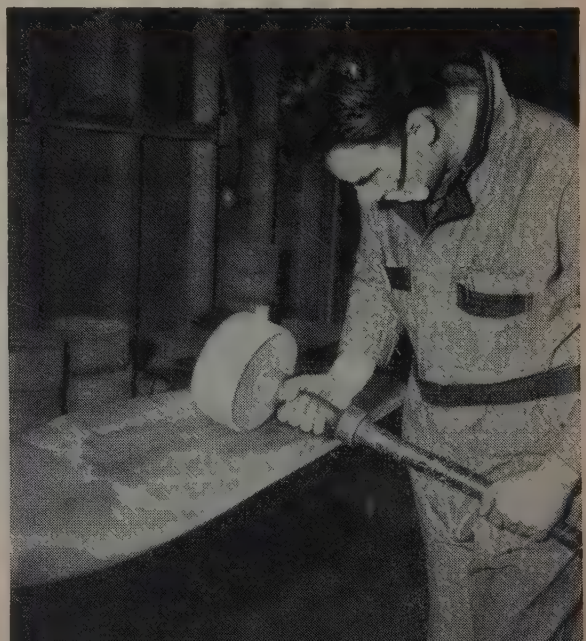
Care and Caution in Props

by TED C. FISHER

Supervisor of Field Service, Hamilton Standard

CORROSION is a prop-blade enemy. Good idea is to occasionally wash down the blades with soap and water. Then coat each blade with clear engine oil. Go easy on polish

BUFFING the prop blades is final step after cuts, nicks and abrasions have been removed. Prop reworker here is John Diorio, Prop Shop foreman for The Babb Company



Routine prop maintenance saves $ and adds to safety in multi-engine operation

THE Hamilton Standard Hydromatic feathering propeller is long famed for its ruggedness and durability. Once identified as the most universal of airline equipment, this propeller—predominately the 22D30, 23D40 and 23E50 models—is becoming increasingly popular on private and executive-type aircraft. No accident, this, as the years of refinement and "bug-ridding" that have gone into its development have resulted in a mechanism that requires a minimum of attention.

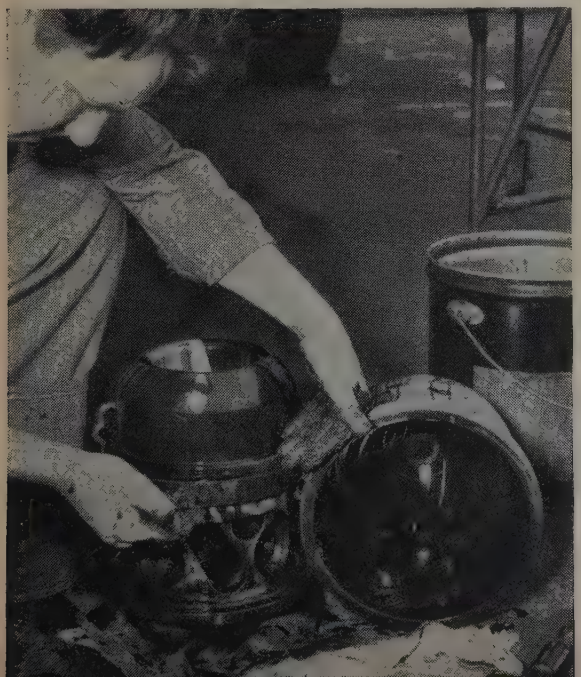
The greatest contribution to this record is the simple design of the unit itself, whereby all internal parts are literally floating in oil, thus maintaining a protective film between wearing surfaces. It is not unusual, therefore, to note commercial operators running similar models to overhaul periods between 2,000 and 3,000 hours, and to note individual propeller times in excess of 20,000 hours. These periods do not hold true for the private operator, however, where the elapsed time element figures quite strongly. Thus, it appears common practice to overhaul propellers at normal engine changes of 750 to 1,000 hours which fall due approximately every two years.

It isn't quite that simple though, and the smart owner will take a bit of time to perform routine periodic maintenance checks not only to minimize possible flight hazard but to save dollars when the overhaul period falls due. Since the major wearing surfaces of these dural-bladed propellers are the blades themselves, some maintenance attention here will appreciably increase life expectancy. The greatest enemies to long blade life are corrosion and erosion. If you're operating around salt water, wash the blades down daily with soap and water and then coat them with clean engine oil as salt water and aluminum just don't mix. Another corrosion factor, realistically more prevalent than the salt-water influence, is the use of corrosive agents in engine and propeller cleaning. Since most private operators understandably try to keep their airplanes spic and span, corrosion of barrel and dome as well as blades is frequently encountered. Go easy on the polishing, it will only add dollars to your budget; simple cleaning is recomended and if you stick to soap and water—or better still some commercially available cleaner such as kerosene, Varsol, etc., with an oil base and a high flash point—you can minimize this trouble. If you've a bit of spare change, get the blades anodized. This treatment, by creating a tough oxide surface, is an excellent and increasingly popular corrosion preventive.

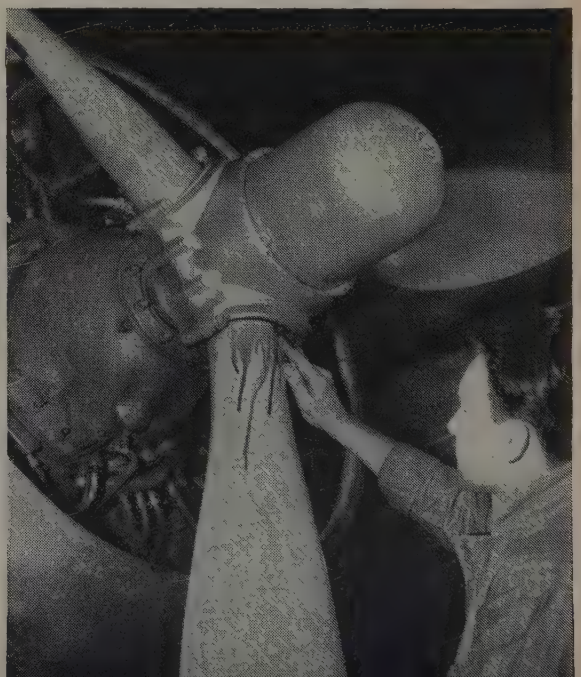
Chances are, however, that nicks and dents in the blade constitute your major propeller concern; what to do with 'em and how to minimize whittling away expensive blade life. To start with, significant nicks and abrasions must be removed since their presence acts as a stress raiser in the blade, thus lowering its strength. This may become significant during flight operation with malfunctioning powerplants (inoperative worn dampers or cylinder-out operation) which can elevate the stresses acting on the blade beyond its design point. Such a combination can lead to tip failures which, although uncommon these days, are a source of continuing research by propeller and powerplant manufacturers.

What's a significant abrasion, you say? Unfor-

PROP DOME acts as a sludge pot, and a build-up of sludge in the dome can cause poor synchronization. Have dome removed occasionally for a good clean-out of the sludge



BLADE SEAL leakage can be "repaired" usually by insertion of a .020-inch feeler gage between the blade and the seal. Sometimes leakage is caused by seal sticking



tunately, no all-inclusive recommendation can be stated in realistic terminology. We do know that inoperative engine-vibration dampers and faulty ignition increases the stresses at which the blade operates. Such stressing is cyclic in nature and this alternate loading and unloading leads to fatigue which can be simply demonstrated by bending a paper clip back and forth until it breaks. If we call the force expended in bending the paper clip stress, and the number of times you bend it before failure, cycles, you have cyclic stress or an example of "fatigue." Hamilton Standard blades are manufactured to operate at an infinite number of cycles at the stress level to be expected from the engine and airplane on which they are installed. This is reassuring as it means that the blades, as well as the other components, are designed for life, whatever that may be in terms of hours and cycles. Although this tremendous safety factor is designed into the product, upsetting influences such as abnormal stressing or gouge damage may reduce the cycles required for failure from infinite, or life, to a reachable figure—just as if you bent our sample paper clip severely (higher stressing) or filed a notch in it (gouge damage). Hah, you snort, I've flown behind fans with gouges the size of pigeon eggs in 'em. We agree—we've done it too—further, we've some blades in our Sales Room that delivered a B-17 crew home during World War II despite having cannon-fire holes in them large enough to chuck a small chipmunk through. However rare and uncommon as a blade failure is, a few minutes devoted to periodic nick removal is a wise procedure.

The only acceptable methods of repairing cuts, nicks, etc., are those by which metal containing and adjacent to the damage is removed from the blade to leave a smooth well-faired surface. Methods which attempt to relocate metal by cold working, such as hammer peening, to cover or conceal the defect rather than remove the damage, have little benefit. Since it is essential that no metal be removed unnecessarily, properly rounding off the edges and smoothing out the surface within the edges is usually sufficient.

A reasonable number of repairs per blade is not dangerous unless their location with respect to each other is such to form a continuous line of repairs that would materially weaken the blade. Finally, blades that have the leading edges pitted from normal wear may be reworked by removing sufficient material to eliminate the (*Continued on page 54*)

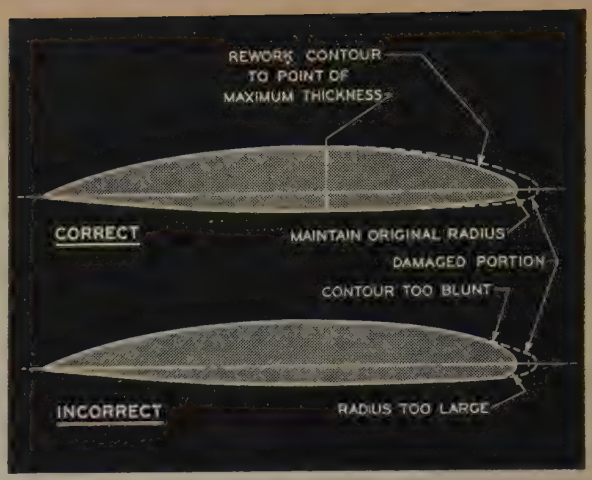
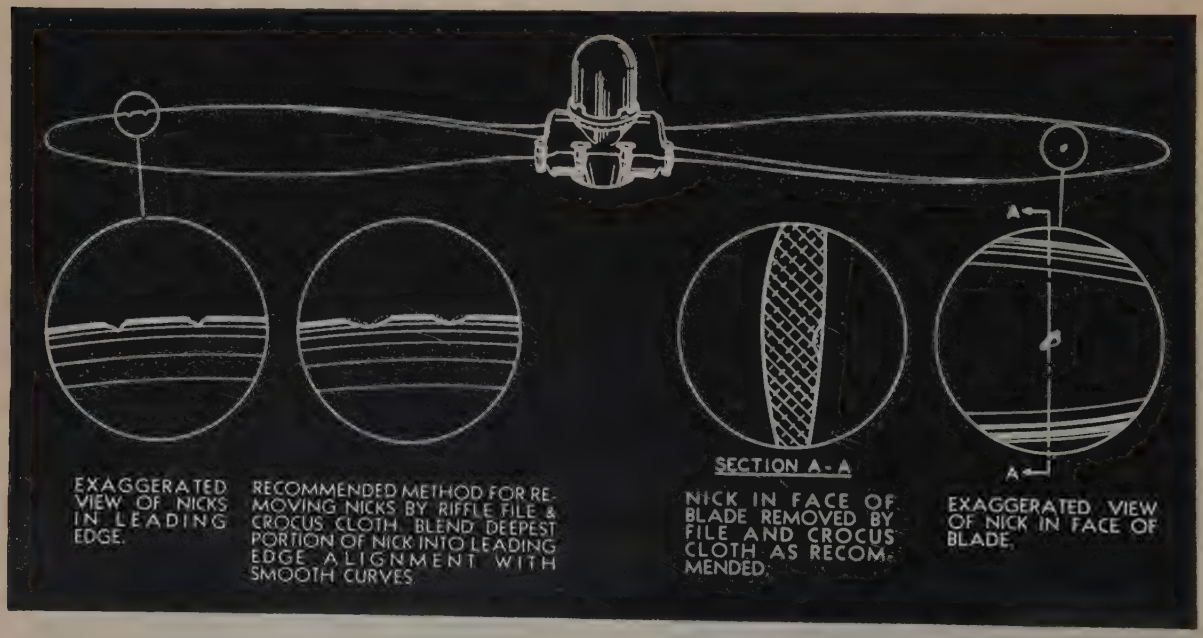


DIAGRAM shows correct and incorrect method of reworking blades that have leading edges pitted from normal wear. Prop contour must remain substantially the same

DRAWING shows exaggerated view of nicks in leading edge and on the face of prop blades, how they look after removal


EXAGGERATED VIEW OF NICKS IN LEADING EDGE.
RECOMMENDED METHOD FOR REMOVING NICKS BY RIFFLE FILE & CROCUS CLOTH. BLEND DEEPEST PORTION OF NICK INTO LEADING EDGE ALIGNMENT WITH SMOOTH CURVES.
SECTION A-A
NICK IN FACE OF BLADE REMOVED BY FILE AND CROCUS CLOTH AS RECOMMENDED.
A
A
EXAGGERATED VIEW OF NICK IN FACE OF BLADE.

EXECUTIVE DC-3, owned by the Garrett Corporation, features one of the most complete radio and navigational instrument installations ever made. Conversion work was done by AiResearch Aviation Service Company, Los Angeles

Design of a DC-3

Executive conversions feature complete radio systems, cabin styling

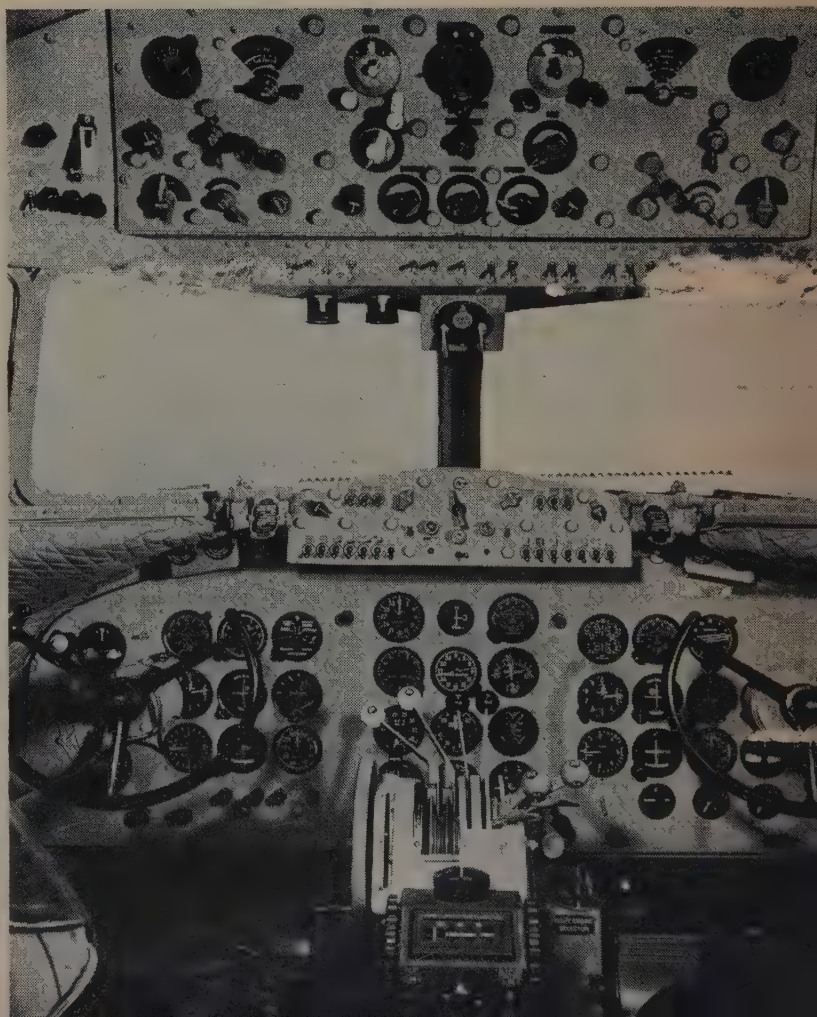
In the field of executive multi-engine aircraft, one of the most popular airplanes has been—and is—the DC-3. With very few new plane designs being offered the corporate owner, the old standby Douglas probably will hold its popularity edge for some time to come. Basically, the DC-3 lends itself well to executive conversion. Flying the skyways for business today are several hundred executive-type twin-engine Douglas' that could win design honors for interior appointments and pilot honors for flight equipment.

One of the leaders in the conversion field is AiResearch Aviation Service Company, Los Angeles, California. Just recently this company delivered newly converted DC-3's to the Garrett Corporation, the Signal Oil and Gas Company, and the Carter Oil Company.

The DC-3 executive transport of The Garrett Corporation features one of the most complete radio and navigational instrument installations ever made. All controls of the system are found on two panels, the audio panel located in the center "V" at eye-level with the pilot, and the master radio panel directly above the windshield.

This centralization of switches and controls permits either the pilot or co-pilot to tell at a glance what audio or which receiver or transmitter is being used by the other. Navy type "red lighting," rheostat-controlled, it is used for night lighting the two panels.

Radio equip- (*Continued on page 41*)



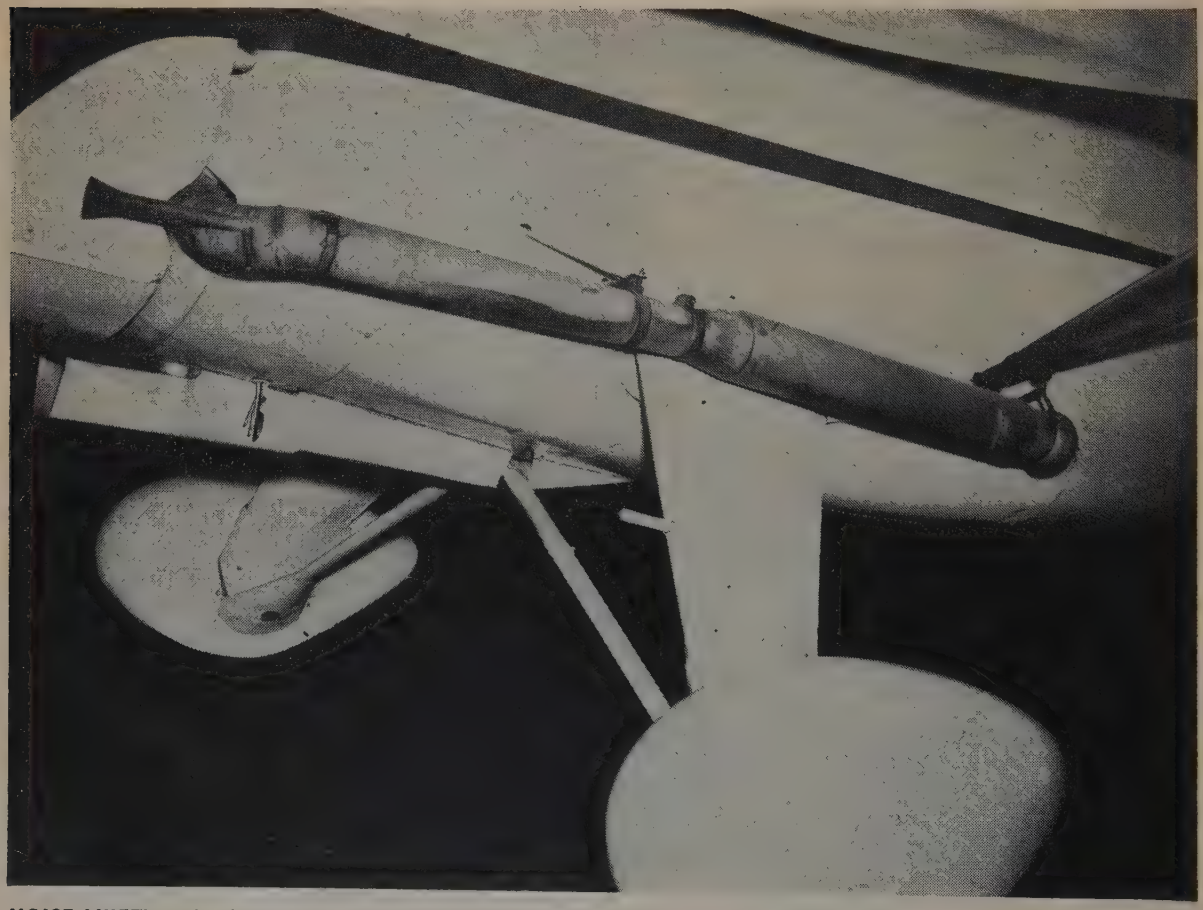
COCKPIT photo shows instrumentation of the Garrett Corporation's executive airplane

Muffler for DC-3 reduces engine exhaust noise; is available for P&W R-1830

CONE DEFLECTORS that induce jet action while scavenging gasses from muffling chamber are pointed out by P. Renner

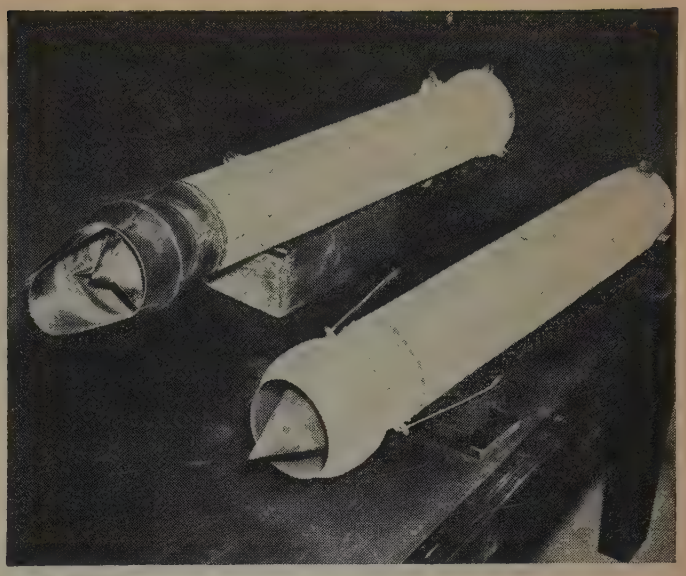
Anti-Noise Muffler

A GREAT hullabaloo is being raised in various parts of the country against the noise of incoming and outgoing air transports. Said hullabaloo is, in fact, almost as noisy as the noise against which the uproar is being raised. But there may be an answer in the offing, an answer developed by the Aero Sonic Corporation, Brooklyn, N. Y. Recent demonstrations of an engine exhaust muffler developed by Aero Sonic indicate healthy strides are being made in the direction of quieter multi-engine operation. Owners and operators of twin-engine executive aircraft may well be among Aero Sonic's first customers, since airline acceptance of a prod-



NOISE MUFFLER developed by Aero Sonic was first fitted to company's Howard DGA-15P. It has been flight tested for over two years. Sound measuring devices show a decrease of 60 per cent in the noise from plane's engine

MUFFLER UNITS consist of perforated tubing *(bottom)*, a blanket of steel wool *(middle)*. Top one is finished job



MANIFOLD-MUFFLER combination *(left)* is undergoing tests on C-47. R-1830 engine muffler *(right)* is CAA-approved

uct takes time—and more time and red tape.

The Aero Sonic engine-exhaust muffler is certainly not a new project. The brainchild of Eddy D. LaTulippe, Director of Research and General Manager of Aero Sonic, dates back 20 years when he first applied a muffler to the engine of a Stinson *Detroiter*. It was then tested and approved by the CAA. During 1940, another model was tested on a Curtiss-Wright *Air Sedan*, and it, too, won CAA approval.

LaTulippe's newest muffler development is expected to similarly win operator approval. One model already has been tested and approved for the Pratt & Whitney R-985-AN-6 engine, it having undergone 538 hours of actual flying over a two-year period on a Howard DGA-15P. This should prove of particular interest to the Executive Twin-Beech and Lockheed owners who use the 450-hp *Wasp* engine.

Working in conjunction with Aero Sonic, Meteor Air Transport, a freight-carrying outfit operating from Teterboro Air Terminal, N. J., has successfully flown a muffler-equipped DC-3 over 85 hours on regular runs. The CAA endurance requirement for passenger planes is 150 hours. Other tests on the muffler have included operating at the DC-3's redline speed of 255 mph, and running for 32 minutes under single-engine condition with maximum permissible continuous climb power. According to the pilot's report, the cylinder-head temperatures never exceeded maximum permissible limits while manometer tests to check the back pressure showed virtually no difference from that caused by the standard exhaust manifold system.

The Aero Sonic muffler is made of stainless steel; is 54 inches long; has a diameter of 8 inches and weighs 50 pounds. Construction consists of the use of one perforated tube within another having four baffles. The outer tube is covered by stainless steel wool blanket a quarter of an inch thick. The inside tube, called the sonic tube, actually consists of two perforated tubings with steel packed between them. Each muffler uses an average of three pounds of steel wool, has three surfaces of 1200 square inches, and nearly 50,000 perforations to absorb the noise as it passes through.

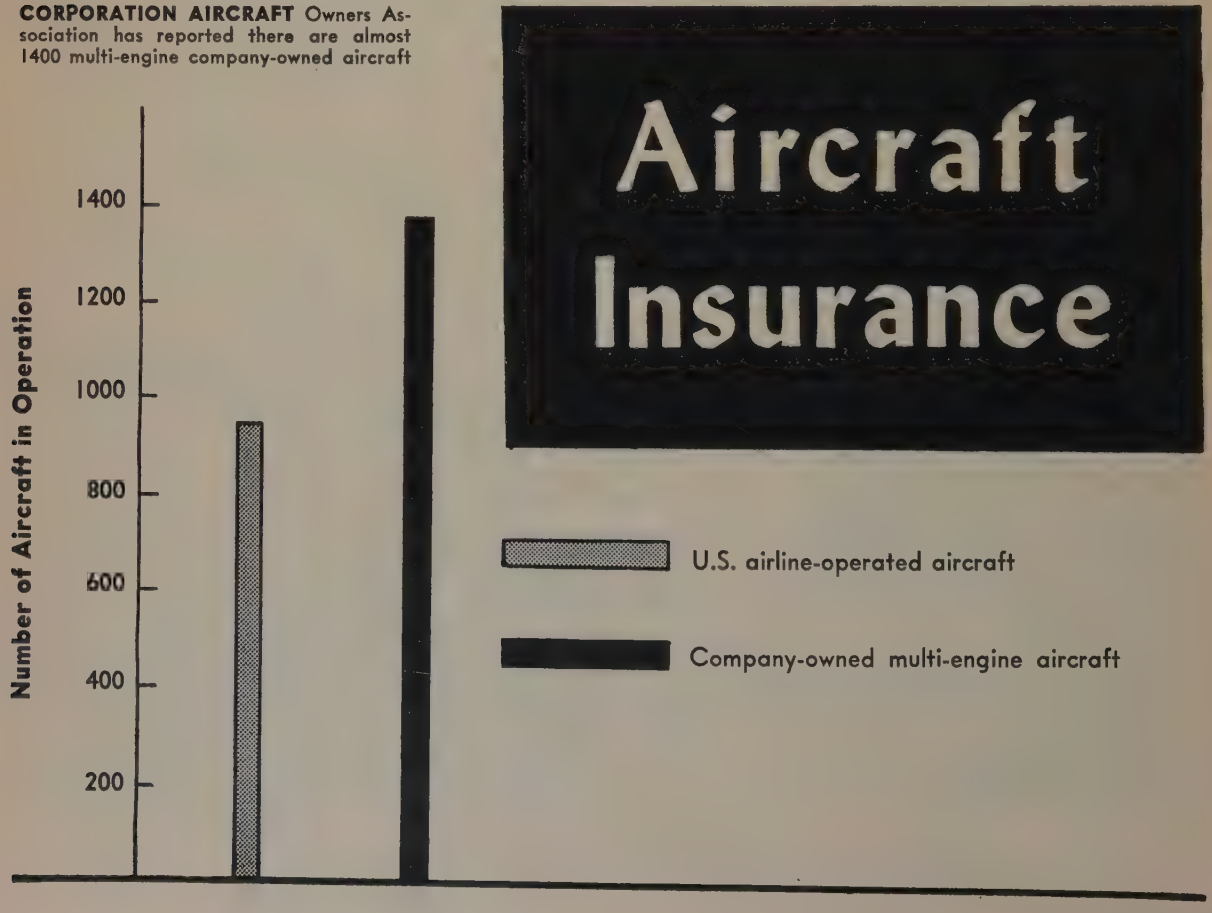
A small funnel-shaped scoop, located forward of the muffler, pipes fresh air directly into the head of the muffler, creating a "wall" of air between explosive fumes which might collect in the muffler and any exhaust fumes which might try to enter the muffler from the engine after intermittent operations or idling. According to Aero Sonic, this muffler system entirely eliminates the danger of back-fire. An especially designed cone deflector, fitted on the aft end of the muffler, adds to the efficiency of the muffler by inducing a jet action in scavenging gasses from the muffling chamber while directing the exhaust to the proper location.

Two versions of the muffler are under development for the DC-3 or Pratt & Whitney R-1830 engines. One version already CAA approved, is fastened to the engine manifold. A newer experimental model fits *within* the plane's manifold, thus cutting down the over-all size of manifold plus muffler. The Aero Sonic manifold, is similar to those used on the DC-3 and C-47, but does not have a heater. This manifold-muffler combination is of the same weight and diameter as the first type but (*Continued on page 47*)

by HOWARD LEVY

ALL-RISK INSURANCE on twin-engine aircraft is estimated to cost roughly 4 or 6 per cent of value of the airplane

CORPORATION AIRCRAFT Owners Association has reported there are almost 1400 multi-engine company-owned aircraft



Industrial Aid Aircraft Insurance is designation given policies issued for the "transportation of company execs"

By FRED G. SCHONENBERG

U. S. Aviation Underwriters, Inc.

This past spring the Corporation Aircraft Owners Association reported that there were "almost 1400 multi-engined aircraft owned and operated by private companies and over 6,000 single-engined planes of a gross weight of 2500 pounds and larger owned and operated by more than 800 companies." In addition, there are hundreds of both multi-engine and single-engine planes owned and operated by individuals in their business or for executive transport. Such is a measure of the acceptance of the airplane as a tool of industry and such also is a portrait of the hundreds of businessmen who must each year decide on the insurance picture for the planes. For those individuals who either own and operate business planes or control the affairs of company planes, here is a survey of the insurance coverages available to "Industrial Aid" users against which to check current insurance policies or new or renewal contracts.

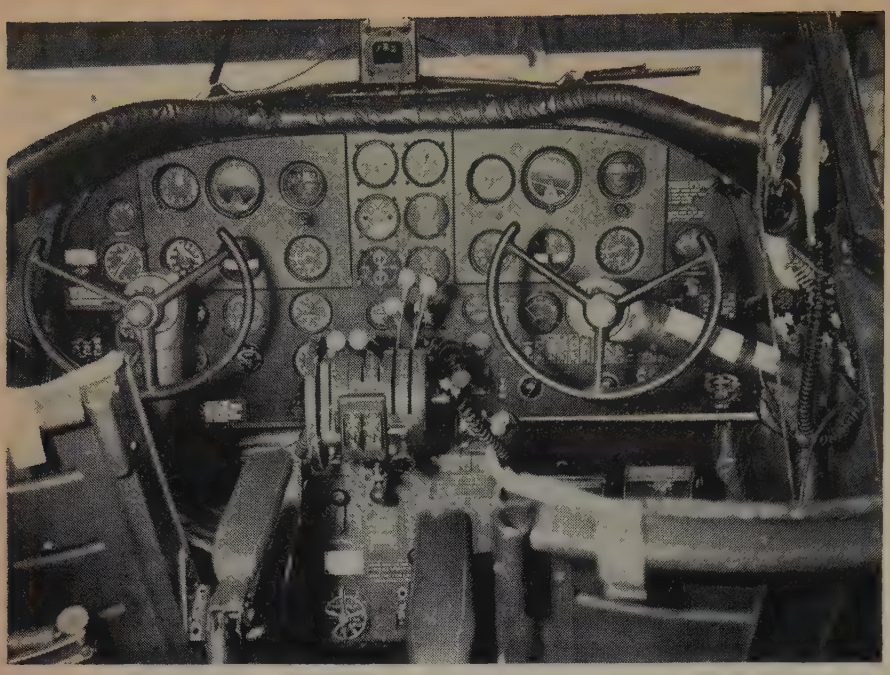
"Industrial Aid" is the classification generally given by insurance companies to aviation accounts either of individuals or companies where planes are used to further the business of the insured without charge to other parties. The term goes further than a straight Pleasure risk by including "transportation of executives, employees, guests and customers, excluding any operation for which a charge is made." "Industrial Aid" sets the risk off as a preferred one by reason of operational records set when business acumen is applied to aircraft selection and maintenance, operation and choice of flying personnel.

"Hull" insurance is the language of the insurance underwriters to label a policy protecting against damage to the owned aircraft. The word 'hull' comes down from the days when underwriters wrote the first aircraft policies on modified Marine Insurance forms. Actually, hull insurance is a good tag, for the word is an encompassing one and the present policies likewise are broad in exposures covered.

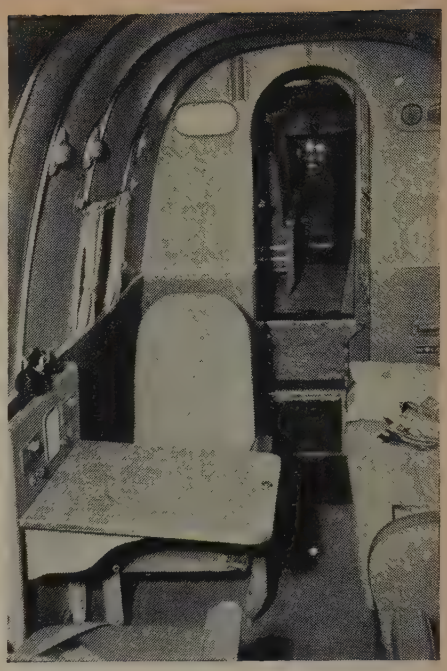
Hull insurance comes in three packages. The first is "Fire and Transportation," purchasable to protect only against damage by the individual perils of Fire, Explosion, Light- (*Continued on page 50*)

EXECUTIVE aircraft are usually insured against all risks on ground and in flight. Liability covers plane crew and executive passengers. Basic policies are Bodily Injury, Property Damage, Passenger Injury

HULL INSURANCE (All Risks) for single-engine aircraft cost anywhere from 7½ to 20 per cent of the insured value. Generally speaking, heavier, higher valued, newer planes get lower rate than older airplanes



PANEL for National Distillers' Douglas B-23 was designed by Pan American. Plane carries nine and crew of two headed by Harold Curtiss, pilot. Co-pilot of B-23 is Don Mosher



CABIN of the B-23 is complete with radio marine phone, couch and folding tables

SKYWAYS for BUSINESS

News notes for pilots and owners of the 8,000-plus airplanes for business

Fuel Selector Valve Modification Adds to Safety

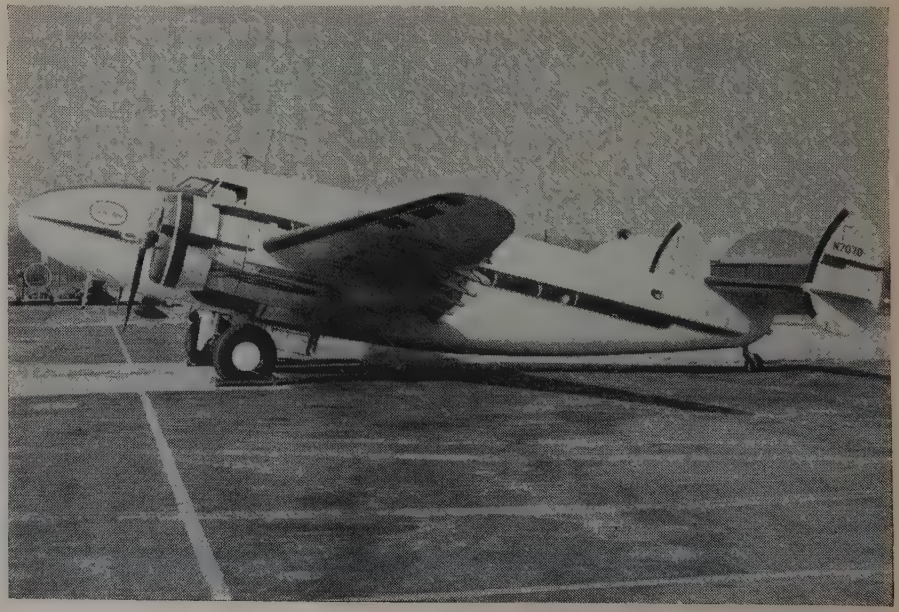
The Sinclair Refining Company, Tulsa, Oklahoma, is one of the nation's leading oil companies, and it is also the operator of one of the largest fleets of business aircraft. Employing 19 pilots and eight co-pilot/mechanics to fly the company's 19 aircraft, Sinclair Refining and its associated Sinclair Companies base the planes at Tulsa, Oklahoma; Independence, Kansas; Chicago, Illinois; Casper, Wyoming; Bucyrus, Ohio; Kansas City, Missouri; Shawnee, Oklahoma; White Plains, New York (Westchester Airport); Midland, Texas; and Bridgeport, Connecticut.

One of the Sinclair Refining Company's ships is N 7070, a Lockheed *Lodestar* that has been in service as an executive plane since its conversion six years ago. Based at Westchester Airport (White Plains, N. Y.), *Lodestar* N 7070 of the Sinclair fleet is piloted by Fred M. Leslie, company supervisor for the New York area. Co-pilots are Kenneth Putervaugh and C. M. Morton.

An extra safety feature of this *Lodestar* is via a small inexpensive modification to the plane's fuel selector valve (*see photo page 35*). The valve is located under the floor adjacent to the main wing spar, and ordinarily is not accessible in flight. It is operated by cables from the selector position handle on the airplane's engine control panel about five feet away.

On one particular flight, the pilot wished to switch from a near-empty tank to a full one, only to have the cables fail. Although he had plenty of gas, the pilot had to make a forced landing because he could not switch to a full tank. Hence . . . the modification: a shaft about five inches long is attached to the selector valve. This shaft is topped by a handle and dial similar to the handle and dial on the engine panel. A small spring-loaded trap door over the handle prevents the accidental turning of the valve. The valve is now accessible to the co-pilot in flight, and should the cables fail, it is a simple matter to reach down and switch tanks by hand. This easy modification has worked so well that the company's other *Lodestar* (N 6060, based at Chicago) has been similarly equipped.

SINCLAIR OIL *Lodestar* N 7070 is piloted by Fred Leslie. Co-pilots are Kenneth Putervaugh and C. M. Morton. This *Lodestar* has been in service for six years



Transport Aircraft Hydraulic Conference in Detroit

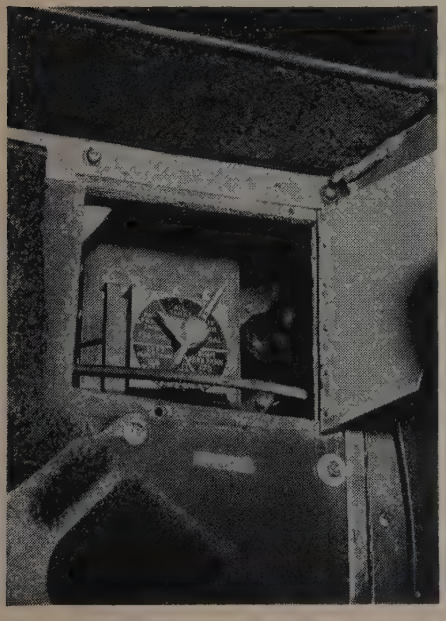
Reports of the increasing use of non-inflammable hydraulic fluids headlined a two-day transport aircraft conference sponsored by Vickers Inc., at Detroit's Hotel Sheraton. Eighty representatives from 20 airlines, commercial airplane manufacturers, fitting and tubing makers and oil companies together with Air Force and Navy personnel participated in a thorough discussion of aircraft hydraulic system components. Conferees heard promising reports on the use of magnetic plug chip detectors.

Monsanto's Skydrol, currently leading the non-inflammable fluid field, was reported to be in standard production and in use on 20 foreign and domestic airlines. Markedly fire-resistant, Skydrol has shown superior lubricating qualities by actually increasing hydraulic pump and supercharger life. But Skydrol does require special Skydrol-resistant seals through the oil system which Hollingshead's Navy-sponsored Hydrolube H-2 does not. The H-2 fluid is presently being flown in over 1600 Navy planes. Hollingshead engineers report its magnesium corrosion problem is solved, but a good high-temperature general-purpose non-inflammable hydraulic fluid is admittedly not yet in sight.

Beech Owners Attend Free Inspection Clinic at PAC

A lot of pounding on the doors of Pacific Airmotive Corporation, Burbank, could be heard following the free inspection of Beechcraft ships during the Annual Beechcraft Clinic held at PAC. The free inspection was a feature of the Clinic. Of the 70 *Bonanzas* that passed through PAC's commercial aircraft section, a large quantity discovered that they required paint jobs, engine changes, radio work, modification and various other odd jobs. For the most part, *Bonanza* owners acted upon the recommendations of the Beechcraft factory experts.

FEATURE of Sinclair's *Lodestar* is modification to fuel selector for added safety



. . . in the Corporate Hangar

Carl Seimer and Bill Pollard brought Trailmobile's *Lodestar* to Spartan Aero Repair for major airframe work, including replacement of both wings due to internal corrosion. In addition, two new R-1830-53 engines were installed, a new instrument panel, a Bendix ADF receiver, a Collins L7-E2 transmitter and an ILS were put in the ship. The *Lodestar's* 12-volt electrical system was converted to 24 volts.

General Motors Corporation's DC-3 #108 is back in operation after some wing attach angle work at Mallard Industries, Bridgeport, Conn.

Chicago Tribune's B-17 is back in service after an engine change, 100-hour inspection and miscellaneous maintenance at AiResearch Aviation Service. The crew that flew the plane back to Chicago included Capt. Howard West, co-Capt. Ray Schlanser, and Flight Engineer Harold Irwin.

National Distillers has added equipment to its B-23; a Bendix NA-3 VHF navigation system with Bendix Omni-Mag and RMI and Sperry C-2 Gyrosyn Compass. Also added was an additional R-9B Glide Slope receiver to provide dual ILS. The installation was done at Atlantic Aviation Corporation's Teterboro, N. J. hangar. Pilot and co-pilot of the National Distiller's B-23 are Hal Curtiss and Don Mosher.

S. D. Murphy of Moulding, Inc., Indianapolis, Indiana, recently took delivery of one of the first production Aero *Commanders*. Mr. Murphy immediately flew his new executive-liner to Roscoe Turner Aeronautical Corp. for installation of a complete ARC radio system.

Pilot Grant Foster flew the Foster Construction Company's Twin Beech to Southwest Airmotive for a double engine change and 100-hour inspection. Flying co-pilot and staying with the plane while in the shop was R. H. Small.

Mellon National Bank & Trust Company's *Lodestar* is back flying after a major overhaul and engine change at Pacific Airmotive, Burbank, Calif. Pilot of the plane is R. Wieland; co-pilot is S. Snyder.

Goodall Fabric's Twin Beech has been in The Babb Company shop for 1,000-hour inspection, twin engine change, gear overhaul, wing removal and inspection, recovering of all control surfaces, radio work, a repaint job and a complete conversion of its interior. Goodall's chief pilot Win Young and co-pilot Al Rieser brought the plane in from its Sanford, Maine base.

Pilot Don McLott and Olie Olsen brought the Grumman *Goose* owned by McLouth Steel Corporation, Detroit, Michigan, to Southwest Airmotive for a 3,000-hour check. Also in Southwest's shop was the Harper Oil Company's Twin Beech for a double engine change and minor repairs. Harper pilot F. F. Pitts flew the ship to Dallas.

If you see a frost-gray with blue trim Spartan *Executive* along the skyways, it'll be the Harvey Smith business plane flown by Herm Reid. The single-engine executive plane has been at Spartan for a complete airframe, engine and propeller overhaul, plus 100-hour inspection and relicensing.

R. T. Brownell, pilot of the Morton Salt Company's *Lodestar*, based in Chicago, brought the plane to The Babb Company for servicing. The plane's main tire and wheel were removed and replaced.

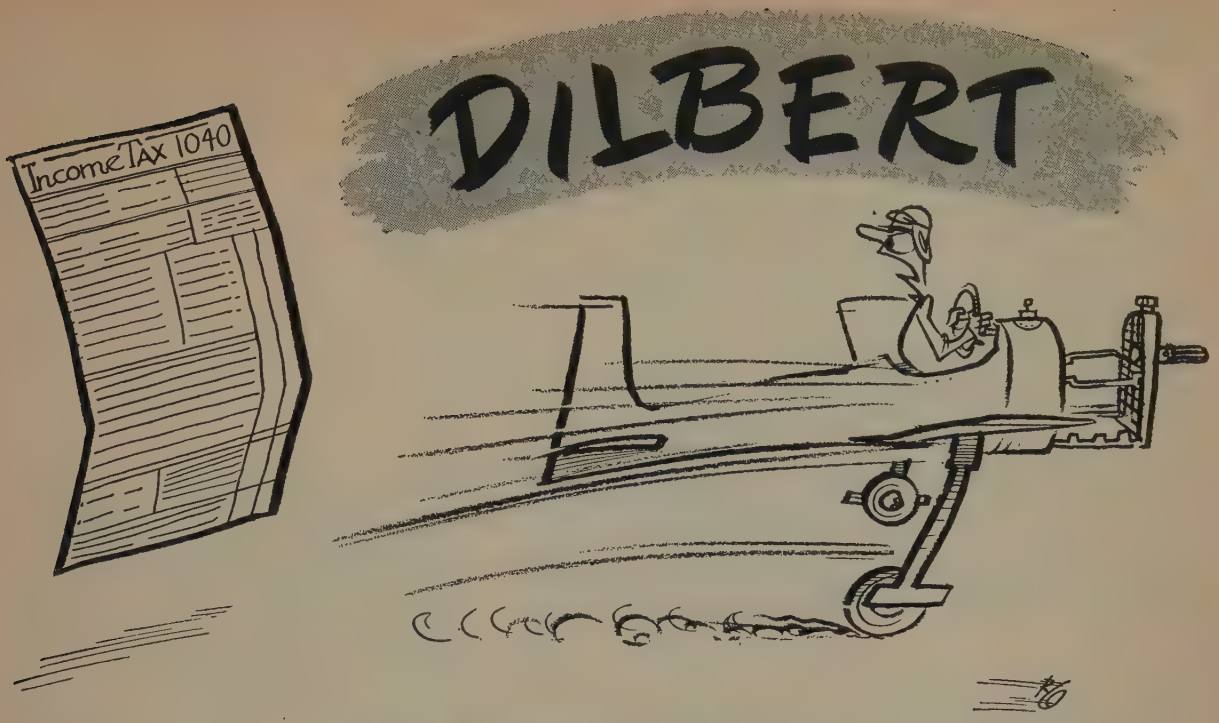
Lockheed *Lodestar* owned by El Paso Natural Gas Company has been in the AiResearch Aviation Service shop for annual inspection and relicensing. Work included gas tank seals, installation of a new oxygen system and the refurbishing of various interior items. Pilot of the executive *Lodestar* is Swede Johnson; Tom Gilley is co-pilot.

E. R. Squibb & Sons' executive DC-3 is to be hangared at Mallard Industries' Bridgeport base.

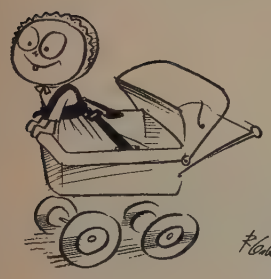
J. L. Gentry flew the Sharp Drilling Company Twin Beech to Southwest for repairs on the automatic pilot SAC's instrument shop installed a couple of years ago. The Twin Beech is based in Tulsa, Oklahoma.

Jean Stroh, pilot of the Max Pray Twin Beech, flew the ship back to its home base, Chicago, after a stem-to-stern overhaul by Spartan Aero Repair. Work included a 2,000-hour inspection, cabin upholstery work, Lear autopilot installation, 15C Omni receiver and ARC-1 transceiver installation, plus a new instrument and radio panel.

"Right way to stop a spin is (1) opposite rudder, (2) stick forward, but Dilbert left the right way out of his book of knowledge!"



By S. H. Warner and R. Osborn



Confession By Mail—A student pilot recently got it off his chest in a letter:

"You know the rush, rush pace of the program. I mention it not as an alibi, merely as background.

"Very early the other morning I found myself at 6,000 feet in an AT-6, ready to practice aerobatics. On my first maneuver, an Immelman, I was dumped into the top of the canopy. Fortunately, I still clutched the tip of the stick.

"It's pretty tough to maneuver from this position, but by pushing the stick around, plus some help from gravity, the ship finally fell out. I fell back into the cockpit, all tangled up in my parachute harness and mike wire. . . .

"I was extremely lucky that the canopy was closed, because both my parachute leg straps and safety belt were unfastened. I still break into a cold sweat just thinking about the possibilities.

"Believe me, after this 'Dilbert,' even though I haven't time for breakfast, I'll always splash cold water on my face and buckle my chute straps and safety belt before take-off."

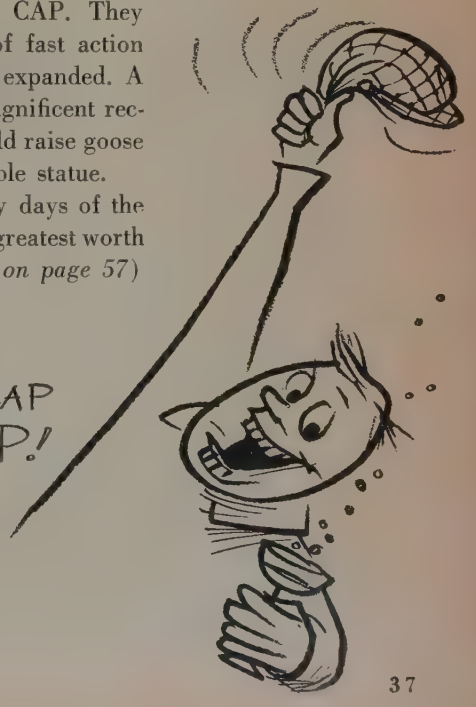
Yes, you *were* lucky, son, because you got a second chance after almost bumping yourself off through your own disregard of basic safety requirements.

Happy Birthday CAP—Did you know the Civil Air Patrol was 10 years old last December? Let's give them a standing salute as their birthday parade passes in review.

Many of you who read this are enthusiastic members of the Civil Air Patrol. Incidentally, that's the only kind of members CAP has—you see, they are all volunteers, serving without pay. CAP doesn't blow its own horn very loud, so we feel impelled at this time to give it a couple of extra toots.

Six days before Pearl Harbor a small group of aviation enthusiasts volunteered for any emergency duty that might arise. That was the beginning of CAP. They soon had plenty of fast action and were rapidly expanded. A review of their magnificent record of service would raise goose pimples on a marble statue.

During the early days of the War, they were of greatest worth along (*Continued on page 57*)



STRATOJET testing clinic at Wichita has its own weather station. Pilots DeHaan and Robinson look over a chart

Test CLINIC

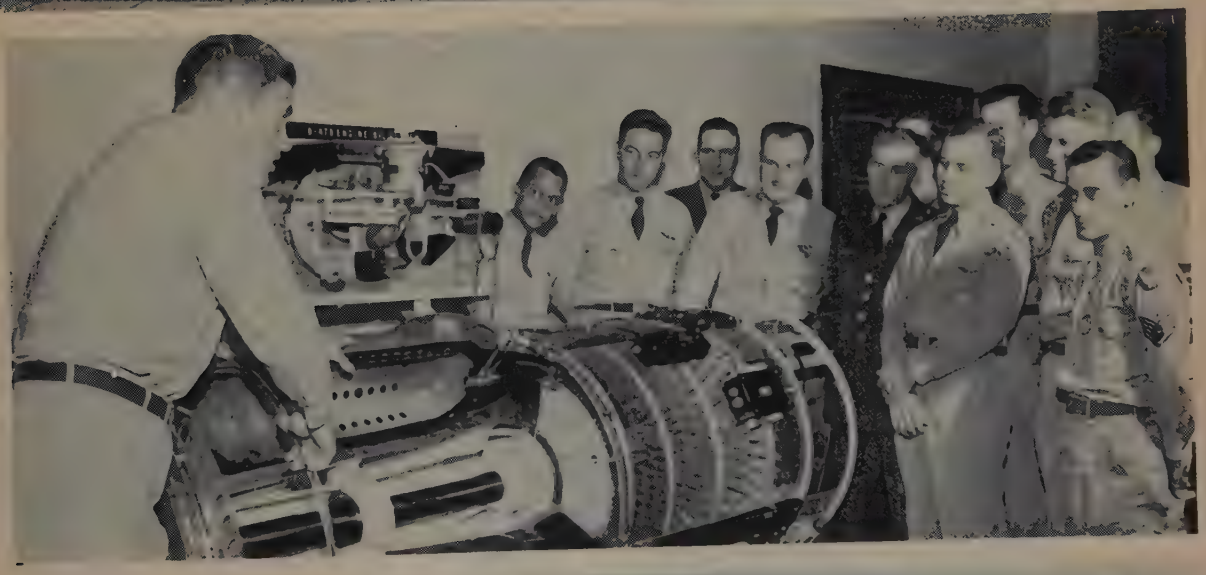
Project Wibac speeds up B-47 delivery, saves a lot of time and money

THE streaks in the sky over Wichita, Kansas, these days are B-47 *Stratojets* on trial flights for Project Wibac, a special testing clinic located at Wichita AFB, adjacent to Boeing Airplane Company plants. The clinic, which gets its name from the one the company uses in reference to its Wichita Division, streamlines *Stratojet* testing operations by combining four tests (Strategic Air Command, Air Material Command, Air Training Command and Air Proving Ground) into a single operation. In command of the clinic is Col. Paul W. Tibbets, Jr. Tibbets and his men check the operational utility of the B-47. Their work has four different phases: 1) locating and correcting "bugs" often found in new airplanes; 2) determining capabilities of the plane; 3) instructing a corps of pilots; and 4) establishing standardized maintenance procedures for use at the bases where the B-47 will be assigned. This program speeds up delivery of the new B-47's and results in big savings in both time and costs.

SWEPTWING B-47 is put through all paces anticipated in service, including RATO (rocket-assisted take-off)

STRATOJETS fly in formation in tests being conducted at Wichita Air Force Base, adjacent to Boeing Airplane Company's Wichita plants

PARACHUTE helps to brake a *Stratojet* after landing on runway at Wichita AFB. The B-47 is powered by six GE J-47 engines; has swept tail



CREW TRAINING is part of Project Wibac. Here, Col. Richard C. Neeley discusses the working of a GE J-47 engine with his class of pilots. Six 5200 pounds thrust J-47's power B-47

AIR FORCE mechanics talk over engine problem with Herb Clayman, Boeing Service Engineer assigned to the B-47's. Boeing plants are located next to the Air Force's Wichita Air Base

CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the members firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. The CAOA headquarters are located at 1029 Vermont Avenue, N.W. Washington 5, D. C.

New Headquarters Office

In order to provide additional space for expanding activities, the CAOA headquarters office has been moved to 1029 Vermont Avenue, N.W., Washington 5, D. C., Room 206. The new location is four blocks east of the former address, and is on the corner of Vermont Avenue and L Street. It is near the center of Washington's fianancial district, and within a couple of blocks of the Statler, Carleton, Hamilton and Ambassador hotels.

There is a reception room with a secretary and a private office for the executive secretary, which provides greatly improved facilities for conferences with member company executives and pilots visiting the CAOA Washington headquarters, as compared with the original location.

During the past few months an increasing number of of member company representatives have checked in at the Washington office for discussion of particular or general problems, and it is hoped that this trend will continue.

New Member

The *Cabot Carbon Company*, of Pampa, Texas, has been accepted as a regular member of CAOA. The company operates carbon black and oil and gas properties, and flies a Twin Beechcraft and a B-35 *Bonanza*. The chief pilot is Ralph W. Prock, who holds commercial, instrument, instructor and multi-engine ratings.

Discussion Meeting for Pilots

In order to provide corporation pilots and key personnel of the CAA and Weather Bureau an opportunity to discuss mutual problems a Panel Discussion Meeting was held on the evening of December 3rd at the Lambert-St. Louis Airport.

The panel was made comprehensive enough to answer completely any operational question raised by the pilots. It consisted of David E. Leigh, Manager of Lambert Field; Glen L. Bowie, Chief Airport Meteorologist, U. S. Weather Bureau; Oliver M. Hasek, Senior Air Route Traffic Controller, CAA; (Mr.) Marion F. O'Brien, Inter-State Airways Communications, CAA; Paul Vinyard, Jr., Lambert Field Tower, CAA; Gordon A. Williams, Jr., Air Carrier Operations Agent, CAA; Edwin B. Schaeffer, Airman Agent, CAA; and Edwin R. Michelsen, Aircraft Maintenance Agent, CAA.

Several key personnel from the CAA Fifth Regional Office, Kansas City, were also present, and their contributions added to the value of the meeting.

S. F. McCullough, Supervising Agent of the St. Louis Aviation Safety District Office served as moderator. He was introduced to the meeting by L. L. Dorrance, Chief Pilot for the Gaylord Container Corporation, who with Herman Dugo of Remmert-Werner, Inc., Ralph E. Piper, Chief Pilot for Monsanto Chemical Company and others, was active in setting up the plans for the gathering.

Additional pilots from the above and other CAOA member companies included representatives from Hercules Powder Company (Wilmington, Del.) Olin Industries, Inc. (E. Alton, Ill.), and Rahr Malting Company (Manitowoc, Wis.).

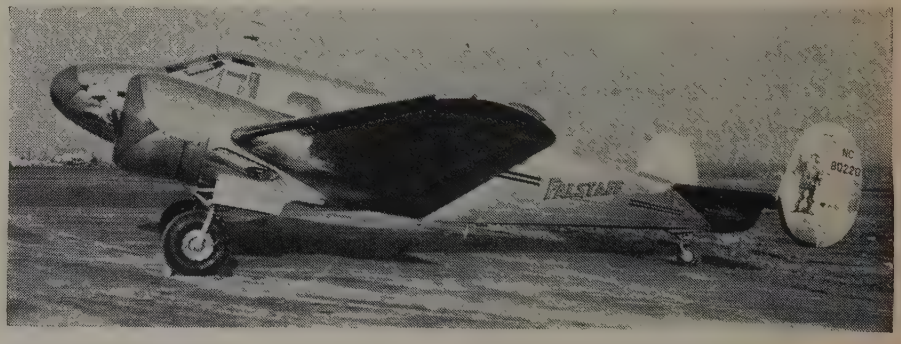
Pilots were also present from the Mississippi River Fuel Corp., Kratz Corporation, Eruehauf Trailer Company and Missouri Airways, making a total of over 20 executive pilots in attendance.

In addition to several questions relating to local conditions at Lambert-St. Louis, a wide variety of topics were covered in the questions and answers. These included Lower Instrument Approach Minimums, Pilot Training Programs, Cockpit Weather in ILS, Filing Flight Plans, Flight Advisory Weather Service (FAWS) and other weather questions, VOR Clearances, etc.

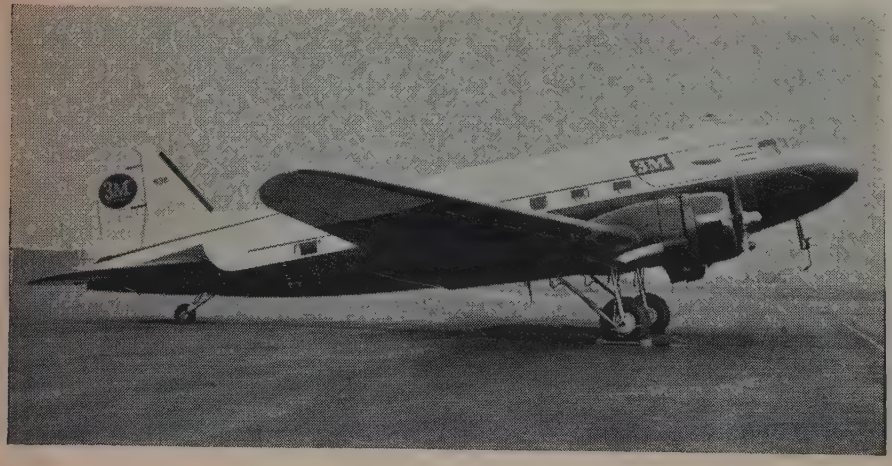
It is planned to provide a fairly complete report of this Panel Discussion, with the questions and summaries of the answers, in the April issue of SKYWAYS. The pilot group expressed the opinion that the meeting had been very successful and voted to hold another one in June 1952, and about every six months thereafter.

This is one of the things which the Corporation Aircraft Owners Association hopes will result from the regional organization now under way, referred to in the *CAOA Report*, SKYWAYS, February 1952. Groups of pilots in the New York area, Cleveland, Detroit, Chicago, Milwaukee-Racine, Minneapolis-St. Paul, Tulsa, Houston and Los Angeles please note!

FALSTAFF BREWING CORP., of St. Louis, Missouri; Omaha, Nebraska; and New Orleans, Louisiana, operates a Twin Beech as well as a Lockheed *Lodestar*. Falstaff Chief Pilot is B. Haddock



3M stands for Minnesota Mining and Manufacturing Co. It operates three converted C-47's out of Twin City Airport in Minneapolis. Chief Pilot for 3M Company is Don Richardson



Five Million Miles

C. F. Zimmerman, Supt. of the Aviation Section, Continental Oil Company, reports that the CONOCO executive fleet has recently chalked up its five millionth passenger-mile without an accident.

Design of a DC-3

(*Continued from page 29*)

ment includes dual Bendix ADF's, ARC low frequency range receiver, 20-channel HF, ARC-1 20-channel VHF Simplex transceiver, ARC-3 24-channel VHF crossband separately controlled transmitter and receiver, ARC-15B ILS and Omni, R-89B Glide Path, Collins 51R-2 ILS and Omni, Collins 51V-1 Glide Slope, Bendix MN-53B marker, and a combined PA air traffic and entertainment radio system.

Instrumentation by Sperry of the Zero Reader and the A-12 autopilot called for a special installation technique in switching from either the Collins or the ARC ILS Omni receivers. Either system may be used to feed the Zero Reader and the A-12, and still have dual ILS indications. Push-button operated multi-wafer rotary switching eliminates the time lag in circuit transfer. Audio switch interference in the cockpit was eliminated with an ARC full isolator, a dual 10-channel three-and-a-half watt amplifier.

One of the best-looking executive transport interiors is that of the Signal Oil and Gas Company DC-3. Passenger compartment installation includes two three-place berthable divans, two full-swivel chairs, two sets of double chairs, a two-place divan, and refreshment and storage cabinets. The forward and aft bulkheads are covered with photo murals.

The aft section of the Signal DC-3 contains a galley with hot liquid containers, hot and cold running water, an ice chest and good cabinet space. A folding leaf formica top covers the sink and ice chest when they are not in use. Behind the galley is a large lavatory, a baggage compartment and the main cabin door with self-contained stairs.

Crew compartment of the Signal DC-3 is completely lined with sheet metal, vinyl covered. It contains a crew lavatory, filing cabinets for maps and ship's papers, and a chart table. Radio racks, oxygen bottles and hydraulic equipment are completely shrouded. A beige balta-flex fabric in a diamond pattern with a brown leather trim has been used to finish the compartment.

The passenger compartment features a brown all-wool thick-pile rug, turquoise upholstery of all-wool frieze. Side panels of the chairs and the cabin walls are of walnut-colored leather. Window panels and the overhead are finished in real wood formica. Molding and trim throughout is walnut.

Other features include windows which are 30 per cent larger than most DC-3 windows, indirect lighting, a continuous-flow oxygen system, ship-to-shore telephone, and a Janitrol heater of 200,000 btu capacity.

Captain Orlin Sorenson is pilot of the Signal Gas and Oil Company plane, Dean Miller is the co-pilot, and Charles Ryno is the mechanic-pilot. The ship is based at Burbank, California.

The Carter Oil Company DC-3's new interior features two large picture windows, each one five feet long and 17 inches high, and 12 enlarged cabin windows. The fuselage is divided into two compartments: one compartment has two divans, convertible to beds, facing each other, while the other compartment consists of six full-swivel reclining chairs and two secretary chairs, one on each side of a desk. Ceiling is of formica with a center panel with indirect lighting.

The aft end of the ship includes a plush lavatory opposite the main entrance door, an ultra-modern buffet of real wood formica, and a large baggage compartment. An automatic Janitrol heater equipped for ground operation is installed in the tail section.

Radio equipment includes dual ARC Omni navigation system, dual ILS facilities, dual Bendix ADF system, Bendix marker receiver, Sperry C2A Gyrosyn compass, Sperry Zero Reader, Collins 180-channel VHF transmitter, ADC 20-channel VHF transmitter, Bendix RTA-1C HF communication system (10-channels) modified for ship-to-shore telephone, Bendix range receiver, ARC isolation system, a custom-built radio control panel with indirect lighting, and a cabin entertainment system with a 20-watt amplifier and FM and AM radio.

The crew compartment has C-46 type pilot seats instead of the usual C-47 type, and the cockpit area is lined with sheet metal covered with a vinyl fabric. The floor is covered with a vinyl-covered cork. There is a cabinet for ship's papers and charts, a closet area and a radio compartment.

The bulkhead at the forward end of the passenger compartment is covered with a photo mural of the Grand Teton country. Cabin floor is covered with thick-pile brown carpet, side panels are covered with brown leather, and the overhead is of real wood formica.

Pilot of the Carter Oil Company DC-3 is Penn Wilson, co-pilot is Jess Collins, and the plane is based at Tulsa, Oklahoma.

Incomparable

a pretty girl

Her warm, continental face and form should be sufficient to protect Jerry Hren against the icy blasts of winter, but we think she looks mighty cosy snuggled in fur. Jerry is a secretary for a publishing firm. She is the serious type and likes to curl up on the sofa with a good book. She is 23, has blue eyes and red hair. (No. 5 in a series of pretty Dallas girls discovered and photographed especially for Southwest Airmotive).

Incomparable

A Custom-Built
Radio Installation
By Southwest Airmotive.

SOUTHWEST AIRMOTIVE COMPANY

LOVE FIELD • DALLAS

Flight Crew Is Ready

(*Continued from page 12*)

fornia, was covered with a near-solid layer of low-hanging clouds at about a thousand feet.

"Left Scanner from A/C, is the smoke increasing or decreasing?"

"Increasing slightly, sir."

"A/C from Navigator, smoke plainly visible above the cowl flaps."

The Flight Engineer rechecked his full panel of engine instruments and said, "All engine readings normal. No loss of oil pressure or volume on number one, sir."

"We're going to circle the field and see if it gets any worse," said the pilot over the party line inter-com.

As the big bomber rolled back over the runway at a scant 1,000 feet, the pilot asked, "Left Scanner from A/C, how does it look from there?"

"Increasing, if anything, sir."

"A/C from Navigator, the same or a little heavier."

The B-29 continued its circle and, for a few seconds, the inter-com was quiet. Eleven people had assorted thoughts.

"We're going back in and land. Give the tower a call," said the A/C. Later, on the ground, Lt. Kusch said that he made the decision to "short" the mission when there appeared to be doubt that the flight would be completed safely.

"A/C from Flight Engineer. Landing weight 120,000 pounds." After a quick glance at one of his charts, he continued, "Our stalling speed will be 110 mph."

"Reduce power slightly on number one," came over the inter-com from the pilot in almost a bored manner. "Gear down and tell the tower we're turning on base leg."

The big landing gear and flaps came down. Each Scanner called in as per routine to double-check the operation. Full flaps creeped down as the heavily laden plane turned in on its final approach. No one on the flight deck looked particularly perturbed as the heavy airplane streaked across the warm-up circle and the tires took a smooth bite out of the runway. The big brakes snubbed the airplane to an easy halt.

"It looks as though someone was pouring oil out of that engine with a gallon bucket," said the Navigator as the B-29 taxied slowly back to the flight line.

Crew Chiefs and mechanics waited in a quiet group as the props idled to a stop. They looked with mixed emotions at the widening puddle of oil under the far left engine.

It was the first "abort" for this particular B-29 since the plane rolled off the Boeing Wichita assembly line in 1945. The log books showed 166 hours on the plane. It was also the first "abort" for the Crew Chief in over 500 hours of B-29 maintenance.

This 12-hour mission was cut to 15 minutes by the failure of just one of the half-million moving parts on a B-29. A rocker-arm pin on number one engine had sheared during take-off. This, in turn, has punched a hole in the rocker-box cover. Engine oil under pressure poured out this hole, down over the inside of the cowling and eventually hit the white-hot exhaust stacks. Naturally, the oil caught fire and streamed a lusty black smoke out of the nacelle.

"No sweat," grinned the A/C as the crew climbed down through the nose-wheel hatch.

"That's what we get for taking a Correspondent along," joshed the Navigator as the flight crew walked leisurely to the nearby coffee wagon.

Ten men of the flight crew, their bright blue baseball caps adding a touch of color to the flight line, sipped scalding coffee and talked about wives, sweethearts or when their next leave was coming up. The "abort" already was a thing of the past.

A half-million dollar airplane and 10 airmen had worked as smoothly as a professional football team to turn what might have been a screaming headline into a routine affair. Strict attention to the Air Force flying safety procedures as taught today made what was once an "emergency situation" only a routine problem.

"Aborts" are remarkably infrequent in the operation of the Strategic Air Command. While over-all totals are classified, one squadron operating from Okinawa against targets in Korea had less than 3 per cent "aborts" during their initial month of flying.

Every pilot knows, however, that as long as airplanes are man-made mechanical machines, there will be an occasional malfunction. Why else spend the training time on simulated forced landings in single-engined trainers? Why else include single-engined procedure in every multi-engined flight check. Why else have the "best three-engine speed," written on the flight slip between the pilots on a B-29, re-checked just before take-off?

When these infrequent emergencies occur, the time spent in training pays off for keeps —and keeps the accident rate to a minimum.

Proof of the teamwork and high degree of training found in SAC crews today is borne out by the experiences of pilots during the "aborts" that occasionally happen. Major Ernest Saliba of March Field was flying with a crew that he had commanded for three years.

"We were just taking off from Guam," explained Major Saliba, "when the engineer reported that number four fuel pressure was going down. The engine went out almost immediately.

"The airport at Guam is built on a hill about 500 feet above the water. We settled

Stepped-Up Production

Indicative of the nation's stepped-up air activity is this line up of sleek USAF Northrop *Scorpions*, all-weather interceptor, being readied for flight. F-89's are rolling off production lines at an ever increasing rate as air defense takes high priority in the thinking and activity of the U.S. The *Scorpion* is particularly suited to air defense. It carries extensive radar search gear which guides it through inclement weather or darkness to seek out and destroy enemy invaders.

half that distance picking up enough speed to stay in the air because we were headed for Okinawa with a full load of spare parts.

"We circled back toward the field and I asked the co-pilot if he had the runway in sight when we had climbed high enough to come on in. He did the looking because I was too busy flying the airplane. Just as we squared away on the runway, the Guam tower called and advised that we were lined up on the wrong runway—one with obstructions all over it.

"When we applied the power to go around, number three engine disintegrated and began to burn. I feathered what was left of the engine and put the fire out with the CO-2 extinguisher bottle, but that left us with a full load and two engines out on the same side.

"By maintaining absolutely precise airspeed, I was able to drag the airplane around the field at about 1 mph above the stall and land without further damage. Slow-flight pilot training paid off that day—and that's just one of the many things that a well-trained SAC pilot learns."

Another emergency that happened recently at March Field helps punch home the pay-off of teamwork and training. Ten minutes out, a B-29 called in that there was heavy smoke in the cockpit and the plane was returning to the base. The Aircraft Commander immediately ordered all crew members to don oxygen masks to avoid asphyxiation. Location of the fire was unknown, but the crew suspected that an inaccessible electric hydraulic pump had jammed in the "on" position.

The pilot radioed that he would attempt a landing on an available runway and advised the tower that he would be off the air for exactly two minutes. Then he had the flight engineer cut the master electrical switch which shut off radios, electric instruments and the burning hydraulic pump.

In the meantime the tower alerted the GCA unit who plotted a bearing for the returning aircraft. When the pilot turned on his electrical system to call the tower again, he was given the exact heading to fly to hit the end of the runway. On this occasion, the teamwork included tower and GCA personnel.

These SAC pilots are extremely resourceful men. When a B-29 ran short of fuel and came in for an emergency landing, the nose wheel stuck in the "up" position. The pilot couldn't circle all day and go through the normal emergency procedure, so he ordered his crew to climb through the tunnel that runs over the top of the bomb bay, one at a time as he rang the "panic" bell. On the final approach with the nose gear up, he had everyone in the back end of the airplane except the flight engineer who was just starting into the tunnel. With the weight of all his crew members in the tail, the pilot braked his ship to an easy stop, with the tail dragging on the ground and no damage to the aircraft.

Another B-29 was forced to make an unscheduled landing at an overseas base with no GCA facilities and a weather report reading zero visibility and a 300-foot vertical ceiling. On his first "pass" over the runway after letting down the radio-range leg, the pilot could see a section of the runway when he broke contact, but he had no way of knowing how much of it lay ahead. His fuel was low, and the weather held no promise of improving. He pulled up and went around as the tower advised him to "home" in over the station and have the crew bail out.

Then the pilot pulled one out of the hat that wasn't in any of the standard operating procedures, but he made it work. On his second "pass" down the radio range, he had one of his crew fire a pyrotechnic flare as soon as the runway was sighted. Then the pilot timed the distance remaining to the runway and again pulled up into the soup.

On his third "pass" into the field, he knew how much runway was in front of him when the flare was sighted, and a normal landing followed. With training like this, is it any wonder that "aborts" are handled in a routine manner?

Standard operating procedure calls for bombs to be dropped on an "abort" over water after take-off. A SAC pilot taking off from Okinawa lost one engine and had a second running rough. He knew that he would lose 8 mph if he opened his bomb bay doors to jettison his load—and 8 mph was enough to put him in the drink. So he kept his bomb load, all set on "safety," and circled back for an uneventful landing.

Commanding General of the 15th Air Force, Major General Emmett O'Donnell, Jr., says that "overcoming serious operational and weather difficulties, the seasoned combat crews, backed up by equally seasoned ground crews, accomplished their systematic destruction of North Korea targets with actually a *lower* accident rate than normally suffered during training missions within the United States.

"Since 80 percent of the flying personnel (of the 15th AF) were combat veterans of World War II, it has been estimated that each B-29 that took the air, carried in its 10- or 11-man crew a combined total of 70 years' flying experience.

"Special attention was given to take-off procedures, including use of landing lights and instruments on night take-offs, non-reduction of power and non-retraction of flaps until safe altitudes had been reached, insistence on correct use of safety belts, and proper technique of feathering an engine on take-off.

"The SOP's that grew out of trial and error were followed to the letter and standardization boards were ever at work overseas to see that new and better methods of operation were utilized throughout the Command. Also, constant checks on the efficiency of Aircraft Commanders and crews were continued. Promotions and demotions made on the findings assured that *only* the very best men were manning the aircraft.

"These are but a few of the features that have kept the flying accident ratio over Korea so strikingly low."

An observer can learn more about the efficiency of any flight crew from a 15-minute "abort" than he can from riding around the world on a routine operation. A large part of the pay-off in old-age insurance for airmen and passengers in big airplane or smaller craft lies in the training for the successful, therefore routine, "abort."

TWA
TAKE TWA FOR A
"QUICKIE VACATION"
in the sunny Southwest
or California
Enjoy TWA's Sun Country Stopover
at no additional fare
See your travel agent or call Trans World Airlines
Across the U.S. and overseas... you can depend on TWA

Operation Clean-Up

With a mission coming up, two Air Force crewmen, Corporal Dominick Grimaldi (*left*) of West New York, N.J., and Tech Sergeant Robert J. Mitton of Los Angeles, get their F-84 *Thunderjet* ready for the take off from an Air Force base in Japan. The machine in use, in spite of its looking and producing the same effect as a vacuum cleaner, is a heater employed to melt ice off the *Thunderjet's* wings. The Republic F-84 is powered by an Allison J-35-A-17 jet engine rated at 5,000-pounds static thrust.

Plane Proximity Warning

(*Continued from page 15*)

installation but sacrificing some of the sensitivity of the receiver.

The spacing of the receivers' antennae would be adjusted to pick up only signals from other aircraft directly ahead or to the side when the aircraft are flying head-on or on converging courses. Thus, aircraft flying in the same immediate vicinities, but above, below, or to the side of each other at safe distances, would not pick up the beams.

When the transmitter and receivers on an aircraft are functioning, the transmitter momentarily short-circuits or disconnects the receivers as each impulse is sent out so that these impulses are not picked up by the plane's own receivers.

"The transmitters and receivers can be made into one compact unit that will fit into a very small space in an airplane," Adler explained. "If they are mass produced, the cost per unit should compare favorably with that of the present VHF aircraft radio sets. The weight, too, would be about the same."

With the electronic equipment installed in proper operating condition, the actual warnings—when they come—would be transposed to the pilot's mind by use of signal lights. Audible or other visual warning devices might be used, if desired. The inventor of API has worked out a method whereby lights on the instrument panel could be utilized in telling the pilot just what to do in an impending air-collision emergency. For the two receivers, there would be two lights located in a conspicuous place for the pilot to note while continually checking the instruments. Each receiver would actuate a light marked, respectively, "right" and "left." This system would be entirely automatic and require the pilot's knowledge of only these three basic rules which Adler has established in accordance with CAA regulations:

1. When both signal lights flash simultaneously and with equal intensity, it means another aircraft is dead ahead. Thus, according to flight regulations, the pilot would make a sharp right turn.

2. If the right light flashes with greater intensity, it means a plane is on the right, cruising at a course that could possibly mean a collision. The pilot would then make a sharp left turn.

3. When the left hand light flashes with greater intensity than the right, the pilot will know that another craft is to his left, and he will make a right turn to avoid it.

If one ship is following behind another at greater speed, the pilot of the first aircraft receives no indication. But the pilot of the following plane would observe both his signal lamps flashing with equal intensity and would make a turn to the right. As soon as each turn is made, the lights would change their indications. Thus, would continually tell the pilot of the changing positions of other aircraft with respect to his own.

The indications could be received from a distance of as much as 20 miles. When a pilot reaches a known congested area, however, he could cut down the range so as not to receive the indication of aircraft other than those in his most immediate vicinity.

For operational safety precautions of each transmitter-receivers set, there would be an additional light that is always on whenever the set is operating. This lets the pilot know he is always protected by the set functioning properly. And when the set is operating, the pilot has one less worry on his mind. If the light goes out, he knows the apparatus is out of service and then it's time to become apprehensive again about what's ahead if visibility is poor. The receivers and the transmitter are capable of being replaced in flight.

Adler, months after his patent was accepted, figured out another possibility for his API that would greatly enhance safety. He said a microphone could be hooked into the circuit of the transmitter and a loud speaker to each of the receiving circuits with nominal additional cost. This would allow pilots to use the same frequency in talking to each other at close vicinities in emergencies. The lights would warn the pilots, and they could exchange data on their positions, speeds, altitudes, and directions verbally, which would be insurance against a mid-air crash.

Though a proximity signal system such as Adler's has never been tried out in the air, the plans for it have been carefully studied and approved by radio engineers and electronics scientists of Johns Hopkins University at Baltimore. C. F. Horne, administrator of civil aeronautics for the CAA, sent a letter of thanks to Adler for his gift stating: "The action of public-spirited men like yourself in making available to the government the fruits of your inventive ability contributes materially to safety in air commerce, and I would like you to know, that on behalf of this agency charged with the responsibility for maintaining safety, I deeply appreciate your generous gift."

Why did Adler donate his patent to the CAA after years of planning and work? One of the major reasons in the case of the API is that, in order to be completely successful, the invention would work only under the development of the government. This is because all aircraft would have to have the special transmitters and receivers, and much money and planning would be required to make the invention practicable.

Another reason, just as important, is Adler's personal philosophy regarding inventions for safety purposes. "I feel that any important discovery or invention that saves lives, whether in the field of medicine or engineering, should be made available to everyone," Adler said. "This is the case in the field of medicine and I feel the same high standards and ethics should prevail in engineering."

In addition to the API patent, Adler has given a number of others to the CAA. One of the most important ones that is now in widespread use is the alternately flashing (two-circuit) position lights. These are flashing lights used today on every commercial airplane in the country during night-flight operations. This was Adler's first major contribution to aircraft safety, made in 1941.

"It was so easy to mistake the steady white tail lights for fixed objects on the ground," Adler pointed out. "I had a number of close shaves during my night flying. When I got this problem out of my system with the alternately flashing lights invention, I immediately began thinking about the poor visibility problems encountered during daytime flying.

"Thinking along such lines made me think of the idea of the proximity indicator. It will take years of additional planning and development by such an organization as the CAA, to make the API practical in the field of aviation safety. And if it ever makes the grade, we will be able to write off another flying worry—that of always being more confident about what's ahead."

Full-Time Fighters

(*Continued from page 21*)

for the completion of their obligated service periods.

Naval Air Reserves have met the test in the skies over Korea

This is no Sunday flying club—Naval Air Reserve is capable of manning 55 carriers of the mothball fleet with aviation personnel faster than the carriers can be "unzipped" and readied for action. Some 50,000 Reservists train at more than 60 locations in the United States.

Even before Naval Aviation had finished its job in the Pacific during World War II, the Navy Department realized the necessity for maintaining a trained force of aviation personnel—pilots and technicians could not be "mothballed" and still maintain their combat skills. Aviation personnel must be kept abreast of modern development and improved techniques. But the American economy could not bear the brunt of a large standing force. Naval Air Reserve, established in July of 1946, was the solution.

Organized Reservists train one weekend a month at nearby Naval Air Stations or Training Units and participate in a two-week annual training duty period. For participating in all scheduled training, each Reservist receives approximately two full months of service pay annually for this rank or rate, and builds up points for retirement.

Most of the pilots in the Organized Reserve are World War II veterans. They fly approximately 100 hours each year in a closely controlled program which keeps their aviation know-how up to date. They take part in formation and instrument flying, bombing, anti-submarine patrol, rocket firing, simulated combat strikes and other operations they would normally be required to perform under full-time war conditions.

Naval Air Reservists operate 16 different types of combat and service aircraft, including the *Able Mabel* dive bombers, the *Bearcat* fighters, and the *Panthers, Phantom* and *Fury* Navy jet fighters.

It might appear that Naval Air Reserve emphasizes training for pilots only. However, the pilot is only as good as his support. He must have the assistance of many specialized ground crewmen to keep him in the air. Officer specialists superintend the numerous ground phases of Naval aviation, so Organized Reserve weekend training extends itself to the classrooms, shops, radio rooms, control tower, photo lab, ordnance department, etc. Reserve officers and rated specialists conduct ground training, utilizing some 30 million dollars worth of technical equipment which has been assigned for this purpose. Many newcomers to Naval aviation have found their places in the ground crew operations, and they, like the pilots, are trained to take their places at sea in a hurry.

Before the outbreak of hostilities in Korea, many Organized Reservists returned to fleet carriers for their two weeks of annual training duty, and within a few days the Reserve pilots proved they could operate from flight decks with the same skill and vigor they displayed in their combat days.

Crewmen, a large percentage of whom had never been aboard a capital ship before, fell into the routine of their tasks with the air of old salts, which can be attributed to the training they received on weekends.

Annual training aboard carriers provided a testing ground for the merits of Naval Air Reserve training, and Reserve pilots and white hats came through with flying colors.

Since, during the Korean emergency, Fleet carriers are not now available for annual training duty, these training periods are held at Pensacola, Florida, where pilots qualify aboard a training carrier.

Naval and Marine Air Reserve maintain their trained aviation personnel at a cost of less than one cent of each defense dollar, or at one-sixth the cost needed to maintain them on continuous active duty—this is economy plus!

The average Organized Naval Air Reserve pilot is a senior grade Lieutenant with over eight years full and part time Naval service. He has been associated with his squadron for about four years, and during this time, he has drawn from the Navy approximately $4,000 total pay for his services.

All the while, he has been building for future income under the Reserve Retirement Act which, after 20 years of active and inactive duty in the Reserve, entitles him to the equivalent of a paid-up annuity which will pay him about $87 a month for life, beginning at the age of 60.

In addition to the compensation paid to each pilot, over 11 million dollars are spent monthly to maintain Naval air facilities where he can train, planes in which he can fly, and supporting personnel, officers and enlisted men, to train him and to keep the stations operating and the planes flying.

The recent recall of some 3,000 "Weekend Warriors" has seriously affected the civilian pursuits of Reservists, but participation in the program has been with the full understanding that they were a part of a ready force, available immediately for any emergency. Messages received from Fleet commanders testify to the thoroughness and efficiency of training received in the Naval Air Reserve Training Program.

To replace the pilots who leave the program, those who become "too old" for combat flying, the Naval Aviation Cadet Training Program functions. The young man enlists in the Naval Reserve and upon acceptance in the NavCad program receives 18 months of intensive flight training. Upon graduation, he is commissioned an Ensign in the Naval Reserve or a Second Lieutenant in the Marine Corps Reserve. He then polishes his skills with 30 months training in the Fleet. At the end of his four-year contract, he is released to inactive duty and encouraged to participate in the Organized Reserve program. The recent initiation of the Civilian Employment Program, which enlists the aid of industrialists and business men near the Naval Air Reserve activities, helps the young Reservist find employment in an area adjacent to a Reserve air station, thereby encouraging him to affiliate with his hometown squadron. If only 22 Naval Reserve aviators, returning to civilian life after training and tours with the Fleet, could be placed each year in jobs in each of the communities reasonably near the 28 Naval Air Reserve stations and units, an additional 616 pilots would be available in the event of a national emergency, and an investment of over 60 million dollars would be salvaged annaully.

As they have taken their places along side the regulars, the "Weekend Warriors" have proved themselves an efficiently trained and readily available force—a veritable Sunday punch for the nation's defense.

Project "SOIAS"

Special cold-weather operations with three Ryan *Navion* Super 260's were conducted by the Air Force this past winter from a Canadian Base to obtain ski design criteria and determine the most effective use of airplane skis under a wide range of snow and ice conditions. Modification included installation of heaters and instruments to record ski data. Test will continue through April.

Equipment Adds Utility

(*Continued from page 24*)

it, weather conditions were below minimum at the airport where he intended to land. The field had an ILS installation, but the airplane had no means of utilizing it and, therefore, could not land. As a result, the conference was missed. Needless to say, the purchase and installation of an ILS receiver commanded top priority as soon as that plane returned to its base. No more missed conferences for lack of suitable means to let down!

Without fear of contradiction, it can be said that in designing, building and equipping present-day executive airplanes, manufacturers have exploited more know-how from the fields of engineering, the various sciences, and from the skilled trades than the manufacturers of any single item in existence. This tremendous reservoir of know-how has been tapped for the prime purpose of incorporating into the airplane the finest safety appointments humanly possible to develop.

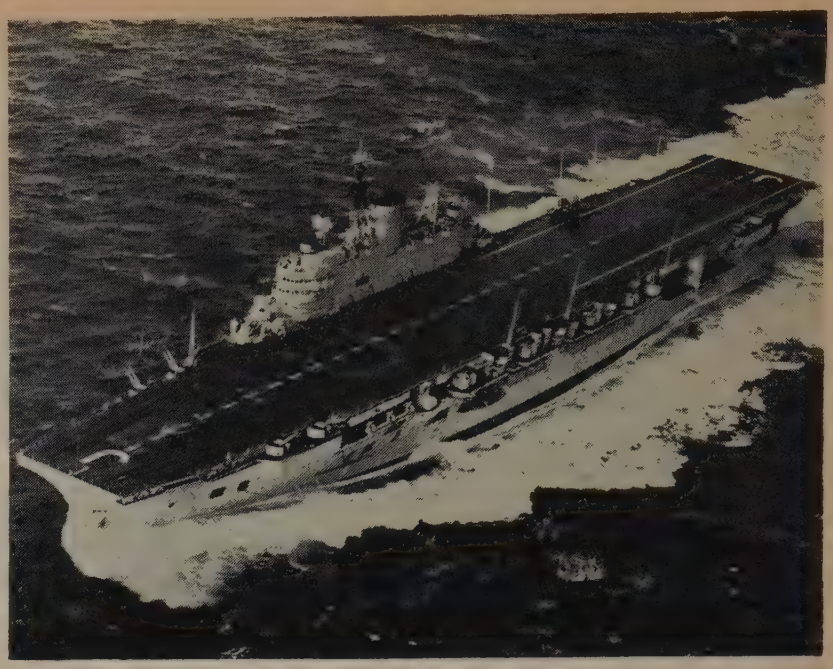
The following paragraphs will outline the design philosophies of such important developments as the Eclipse-Pioneer PB-10 Automatic Pilot, Flight Path Control, the Gyro Fluxgate Compass, Dual Radio Magnetic Indicators, and Omni-range equipment. For the accessory group which contributes greatly to the high safety standards characteristic of the corporate plane, Eclipse-Pioneer has developed de-icing devices for all-weather flying and numerous high-efficient electrical powerplants that reflect long years of expensive research in the field of accessory development.

PB-10 Automatic Pilot—

The PB-10 does more than merely hold the plane to a straight course and a level attitude; it is a complete system for all-electric flight control. Like the human pilot, it applies forces to the controls of the airplane to maintain it at any desired attitude or heading; but it does it precisely and automatically. References are established by the PB-10 to which the plane is flown. When deviations with respect to these references occur, the system senses such changes electronically and operates the rudder, ailerons and elevators accordingly.

Basically, the PB-10 system comprises eight components whose gross weight is little more than 100 pounds. Five of the eight components include the Gyro Fluxgate Transmitter, the Amplifier-and-Signal-Generator, and three servos which, for practical consideration, are referred to as the working units of the system. The other three, the Master Direction Indicator, the Pitch Trim Indicator, and the Controller, provide indications and provisions for the pilot to manually operate the controls. The system includes, in addition to components, four simple switches which may be employed to control specific functions of the equipment.

The manner in which the PB-10 maintains straight-and-level flight is relatively simple. Should changing forces, such as turbulent air, cause the plane to deviate from its magnetic heading, the Fluxgate Transmitter, mounted in the wing or tail structure, electrically senses the change due to its change of position in the earth's magnetic field and transmits a signal to the Master Direction Indicator. Here the signal serves two purposes: to drive the dial of the Master Direction Indicator and to provide a course signal for automatic control of the rudder.



BRITISH CARRIER, the *HMS Eagle,* is the largest British aircraft carrier afloat. Built at a cost equivalent to $39,583,600, the *HMS Eagle* weighs 36,800 long tons, carries 100 aircraft, including a jet squadron, and has a crew of more than 2,000 men. The *HMS Eagle* will join the Fleet this spring. It brings the Royal Navy's strength to 13 carriers, 26 cruisers, five battleships

The course signal is transmitted to the Amplifier where it is strengthened and modified to become a working signal with characteristics necessary for the application of power to drive one of the three servos. The servo, mechanically linked to the control system of the airplane, drives in the proper direction to provide appropriate control to return the plane to the referenced magnetic heading.

Because of inherent inertia about the yaw or rudder axis, the rate of deviation as well as the amount must be taken into consideration to maintain close control and prevent over-control. By superimposing onto the course signal a rate signal originating from a Rate Gyro in the Amplifier-Signal-Generator, the applied rudder is proportional to both the amount and the rate of displacement in yaw. In short, if the nose of the plane is displaced fast, a larger signal is initiated to bring it back faster. The result is tight control in the roughest air.

Aileron and elevator references are established by a vertical Flight Gyro, sealed and protected on the chassis of the Amplifier-Signal-Generator. Characteristic of a vertical gyro, gyroscopic inertia compels it to remain upright regardless of any change in the plane's attitude. Should the plane depart from these references, signals originating from the Flight Gyro are amplified and appropriately modified to provide control which will return the plane automatically to its proper attitude on these two axis.

As a safety measure, the Flight Gyro is monitored by a photo-electric cell which indicates, by way of a neon light, when the Flight Gyro is erect and ready to use. Similarly, this light denotes its condition to the pilot in the event of failure.

With the PB-10 there is the provision for the pilot to maneuver the plane at will while the auto-pilot is engaged. To make a precision turn, the pilot merely turns the pistol-grip handle of the Controller to the right or left. By so doing he manually creates signals for the three control surfaces in proper proportion to each other to produce an automatically cooordinated turn with sufficient up-elevator to hold altitude. When the plane is turned to the new heading, the handle is merely centered and the plane automatically assumes a level attitude and is henceforth held to the new heading.

To climb or descend, the pilot simply turns the Pitch Knob on the Controller. To alter the plane's degree of bank, the pilot turns the Bank Knob on the Controller and is able to maneuver the plane on its bank axis.

At any desired altitude the pilot may engage a constant-altitude control by merely throwing a simple toggle switch and that chosen altitude will be maintained. An aneroid does the work here. With any change in altitude, the aneroid either expands or contracts. This sets up an electrical signal which is applied to the elevator channel and, through elevator movement proportional to the aneroid deflection, the plane is returned to its referenced altitude.

A Pitch Trim Indicator is a part of the system to assure safety and economy. Should the elevator servo be forced to apply elevator to correct for an out-of-trim condition, it is registered on the indicator. The pilot then will balance the plane with the ship's elevator trim wheel. If a trim tab servo has been added to the PB-10 system, it will do this for him automatically.

(*Continued on page 48*)

Anti-Noise Muffler

(Continued from page 31)

is two inches shorter. To date, it has undergone 37 hours of tests under close CAA supervision on a Meteor C-47 freighter on that company's regular charter flights out of Teterboro Air Terminal.

Aero Sonic will also have a similar muffler available for aircraft using Pratt & Whitney R-2800 engines; in other words, a muffler to fit just about every transport built today. However, the R-2800 muffler will require double units for each engine because of the greater power of the engine. The prototype muffler is the same size and weight as the C-47 model and is to be tested on a C-46 leased from the government and operated by Meteor. With this particular type plane, an extension is attached to the manifold on each side of the engine with the two mufflers per engine in turn attached to the extensions. As the CAA requires 150 hours of service test for airline material, the C-46 will be operated on Meteor's regular freight-carrying flights.

According to LaTulippe, Aero Sonic plans to develop a single muffler that will fit all large aircraft, only requirement being different brackets for each type plane. The mufflers are to be constructed of a new metal, a combination of stainless steel and titanium, capable of withstanding 3500° of heat without affecting the metal. They will be sold in "package" form, with sales probably handled by aircraft parts suppliers throughout the country, also licensed by Aero Sonic to produce the units.

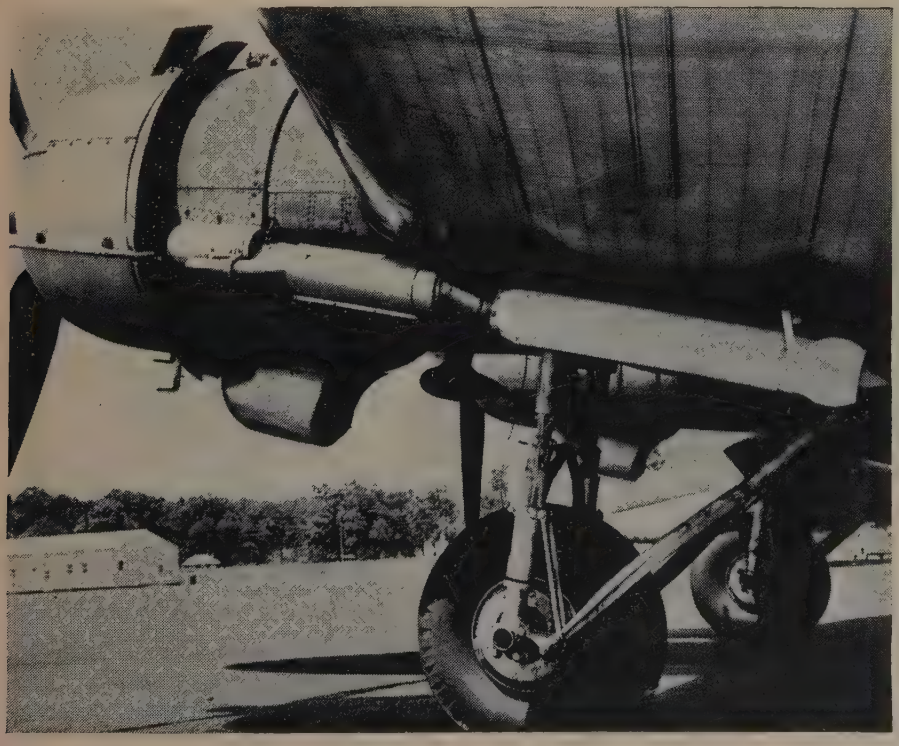
The DC-3 muffler is ready for the market now, and Aero Sonic plans delivery of the units three weeks after receipt of orders. The cost of the DC-3 muffler will be about $650.00.

On the basis of tests conducted by the College of Engineering of New York University which showed a decrease of 60 per cent in the sound level of the muffler-equipped Howard, and hearing Meteor's C-47 flying overhead but making no more noise than the small-engined *Bonanza*, a number of people feel that LaTulippe and his Aero Sonic muffler have gone a long way in answering anti-noise committee complaints. In fact, one Mayor of a large eastern city is said to be right now ready to sign a bill requiring all aircraft utilizing that city's airports to be equipped with mufflers.

As this issue went to press, the Aero Sonic Corporation completed plans to demonstrate the engine muffler at New York International Airport (Idlewild). Among those invited to attend the "show" were members of the CAA, the Port of Authority, Congress, New York City officials, the Air Force, Navy, officials of several airlines and members of the Queens Anti-Noise Committee. This demonstration undoubtedly will prove the efforts of Mr. LaTulippe and the Aero Sonic Corporation to be just as successful as pilots of the muffler-equipped planes have predicted they will be.

Aero Sonic has received over 2500 letters of inquiry from the airlines, corporations with executive aircraft, and private pilots throughout the world. Designer LaTulippe and Aero Sonic President T. L. Carras believe that in the very near future they will have available a muffler adaptable to any type plane, be it Luscombe or DC-6.

Also under development at the company's 6200-square-foot plant at Englewood, N. J. is an "anti-zooming" propeller with automatic pitch control, another of Eddy LaTulippe's projects in his fight to further remove the objectionable element of airplane noise. This propeller will be covered in more detail in a future issue of SKYWAYS.



AERO SONIC muffler is shown here attached to a C-47's exhaust manifold. A funnel running forward along cowling scoops in fresh air and prevents backfiring in the muffler

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TRI-STATE COLLEGE
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Equipment Adds Utility

(*Continued from page 46*)

The design philosophy of the PB-10 reflects carefully considered and proved design features which make it more than a mere relief pilot. Efficiency, economy, and reliability of flight operations are the results of flying on PB-10, distinctive standards for the ultimate in flight.

Instrument Landing System—Before going into Flight Path Control, some consideration should be given the Instrument Landing System from which FPC receives its activating signals.

The Instrument Landing System, to which FPC is connected, is a part of the standard CAA radio equipment installed in most transports and executive aircraft. It consists of two separate receivers for intercepting localizer and glide path beams, a control box, and a cross-pointer meter. Each receiver is tuned to the frequencies of the beams the pilot wishes to track.

The cross-pointer meter is an indicator with two pointers, each operated by signals from the respective receivers. Actually, the meter housing contains two sensitive center-reading d-c voltimeters, the pointers of which are crossed on the face of the indicator. The vertical pointer is actuated by the output from the localizer receiver and the horizontal pointer by the output from the glide-path receiver.

When the pilot tunes in the carrier frequency of a particular range, he actually tunes simultaneously two signals from two carrier waves of the same frequency which are modulated at different frequencies. Transmitted, these carriers are directional, overlapping fields. At the center of the overlapping section, between the two fields, the field strength intensity of the two is equal. This line of equal intensity is the beam. On either side of the beam, one or the other of the two fields will be stronger. It is this difference in field intensities that is employed to determine the angular displacement of the airplane in relation to the beam.

In order to separate and identify these two fields, the receiver incorporates two filters which function simultaneously. One filter passes the modulated frequency of one field, the other filter passes the modulated frequency of the second field. Each filter's output is rectified and thus emerges a d-c signal. The two outputs are combined to produce, in effect, a single differential d-c signal which is applied to the cross-pointer meter and actuates the one-pointer.

Thus, as the intensity of the radio fields balance each other, the one filter's output exactly balances the output of the other. The result is zero differential, no current flow, and no deflection of the pointer. But, when the plane is on one side of the beam, the radio signal received from one field is stronger than the other. This results in current flow and a resultant deflection of the pointer. The strength of the differential signal controls the amplitude of the pointer deflection, providing a direct indication of the angular displacement of the plane from the beam.

Such is the manner in which the localizer and glide path receivers of the Instrument Landing System furnish signals to operate the cross-pointer meter and provide a visual indication for tracking the beam manually.

Although the signals from the two receivers are appropriate to cause movement of the cross-pointer meter and to provide excellent visual indications for tracking the beams in manual flight, they lack the necessary control characteristics for tracking the beams automatically. Consequently, to produce the needed control characteristics, an additional intermediate component between the receivers and the PB-10 is needed. This is the function of Flight Path Control.

Flight Path Control—A sequencing switch connects the output of the radio receivers to the input of the Flight Path Computer. Therefore, whenever the PB-10 is engaged, with the sequencing switch in the desired position, the Computer originates signals which are applied to the signal system of the PB-10 and holds the airplane automatically to the radio beam.

As a safety measure, FPC is automatically disconnected when the PB-10 is disengaged. The pilot merely touches a release switch on his control wheel to disengage.

Should the pilot desire to fly a radio range, he merely uses his PB-10 Controller until he approaches the desired range. Then he tunes his radio receiver to that range. When the plane flies into the radio field, the vertical pointer of the cross-pointer meter moves off center, right or left, depending on the position of the plane with respect to the on-course beam.

As the pointer starts to move, the pilot maneuvers the plane to the published magnetic heading of the beam and merely moves the sequencing switch to the "Range" position. FPC takes over and the plane automatically turns to the on-course beam, orients itself to it and stays there.

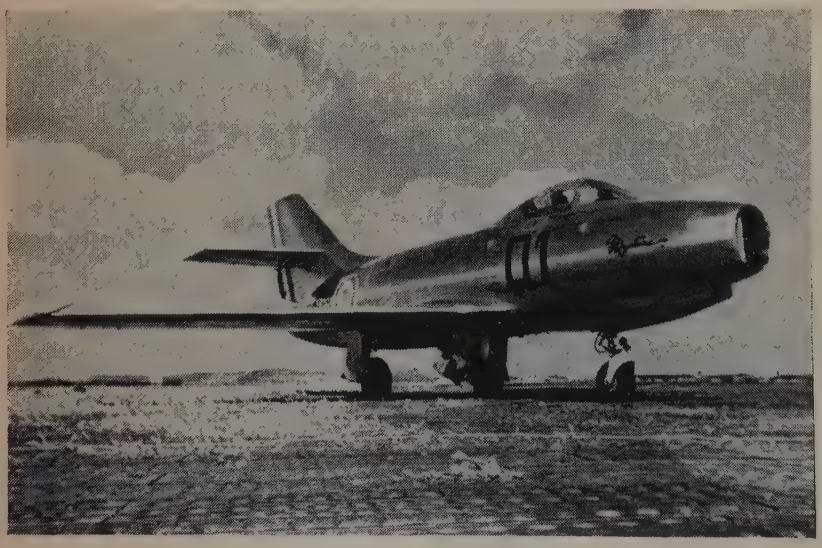
When the sequencing switch is turned to "Range," the signal which actuates the vertical pointer is fed to the Flight Path Computer. This signal controls the operation of the computer which calls upon the PB-10 to head the plane into the beam. The computer, in addition, reconciles the position of the plane relative to the beam direction.

In this fashion, rudder and aileron control is applied in such a manner that the angle of approach to the beam is gradually diminished until the plane is tracking it.

Once centered on the range beam, in spite of drift conditions, the plane assumes and maintains the correct crab angle. As a result, the plane is constrained to a precise ground track. The computer will not sense and translate into flight any waves or interruptions in the beam and will not permit control to vary with changes in radio-receiver sensitivity. In flying cross-country all the pilot has to do is to retune the localizer receiver to the new ranges and occasionally slightly alter the heading to conform to those ranges.

To make an automatic landing approach with the PB-10 engaged, the pilot manipulates the Controller and flies toward the localizer beam, meanwhile tuning in the localizer station. When the vertical pointer starts its deflection, he turns the plane to the magnetic heading of the beam and turns his sequencing switch to "Localizer." FPC then orients the plane to gently bracket and track the localizer beam.

While the plane tracks the localizer beam at an altitude sufficient to intercept the glide path beam, the pilot monitors the horizontal pointer of the cross-pointer meter. When the



Dassault MD-452 Mystere

The Dassault MD-452 *Mystere* is a sweptwing version of the MD-450 *Ouragan*, France's first fighter design to go into production since World War II, the prototype *Mystere* began its flight tests in 1951, and a recently recorded speed was said to be 633 mph in level flight. The prototype is powered by an Hispano *Nene*, but the production model will carry either the French Atar 101 (6,170 pounds thrust) or the Hispano *Tay* (6,250 pounds thrust). Armament includes four 20 mm or 30 mm cannon.

pointer approaches the center of the meter, indicating proximity of the plane to the glide path beam, the pilot moves the sequencing switch to "Localizer and Glide-Path." FPC takes over to produce elevator and throttle signal, as well as rudder and aileron, and the plane tracks the glide path beam.

With the sequencing switch in this position, the computer sees two signals: the localizer signal which actuates the vertical pointer, and the glide path signal which operates the horizontal pointer.

In the same manner as the localizer signal is employed in controlling the rudder and ailerons in tracking the localizer beam, the glide path signal is used by the computer to provide proportional output to properly control elevator and throttles.

A calibrated portion of this signal output is provided the elevator signal system of the PB-10. The remaining portion of the signal actuates the Throttle Servo.

Flight Path Control provides purely automatic flight both cross-country on predetermined ground tracks or during approaches. In so doing it has provided a solution to one of aviation's most difficult problems, reliable and safe operations in spite of weather conditions.

Omni-range Equipment—There is probably no other single apparatus in modern aircraft that imparts to passengers as singular a sense of security and satisfaction while flying through heavy static or blinding clouds as VHF navigation and communications equipment. Because it is relatively new, there are still a large number of commercial and private pilots who have yet to enjoy this experience. Many of them have, however, employed as a navigational device, low-frequency and two-way radio contact with airway stations and towers. Most of them, too, are quite familiar with ADF. VHF, because of its simplicity and dependability under all conditions of weather, is the inevitable successor to ADF.

VHF operates on a 108 to 136-mc range and receives communications, omni-ranges, two-course VHF ranges as well as phase or tone localizers. No tuning is required nor must the pilot exasperate himself by searching for frequencies. The equipment is operated by just one control.

To intercept an omni-range station, the pilot simply consults a chart to ascertain its frequency, which in the case of the Harrisburg station, for example, is 112.8 mc. As simple as tuning a household radio, he then turns a switch to 112.8. Seconds later and with high fidelity because of the crystal control incorporated into the circuitry, he is on the desired frequency. Such is the case also with respect to localizer, communications or omni-channels throughout the entire 280 available channels, each 100 kc apart.

The basic instruments with which the pilot is concerned are three, a "three-in-one" instrument (which contains an omni-bearing selector, a cross-pointer indicator and a relative heading indicator), a "radio magnetic indicator" which provides the same information as ADF, and a frequency selector.

The radio-magnetic indicator, used in combination with the omni receiver, virtually guarantees success with respect to omni-ranges. The heading-sensitive ADF-type indicator imparts all information on one dial. A pointer points to the station (the heading is at the very top of the instrument), and the bearing, relative to the station, is indicated by the pointer. In addition to its simplicity, VHF omni offers the pilot ease of orientation equivalent to ADF. In reality, here is ADF and VHF combined.

With VHF functioning, should the aircraft be headed in the direction of a selected course, that is, either on it or parallel to it, the heading pointer will naturally indicate straight ahead. However, should the plane stray right or left of this direction, the instrument promptly informs the pilot which way the plane is pointed. If the indicator's short pointer indicates the plane's heading to be toward the right, the plane must necessarily be on the right, and it will approach the course. Should the vertical deviation-indicator, which denotes position with respect to the course, and the relative heading indicator be maintained in an aligned position, the plane approaches the course at an appropriate rate.

Should crosswinds be encountered, the plane will drift right or left. The heading-pointer then denotes the change. Meanwhile, the deviation indicator remains stationary. In this manner, drift is indicated. Correction to the right eliminates drift to the left, and as the plane is returned to on-course heading, the crab angle is denoted by the instrument's short pointer.

Instrumentation—Adequate instrumentation is every bit as essential to the economical and safe operation of all types of aircraft as engines of appropriate size. The executive should not become economy-minded with respect to the instrument panel, and the following tabulation should be regarded as a "*must*" concerning minimum instrumentation.

Master Direction Indicator } Components of Flux-gate Compass System
Magnesyn Repeater }
A Standby Compass
Radio Magnetic Indicator
Electric Turn and Bank
Electric Horizon Indicator
Altimeter
Airspeed
Rate of Climb
Power Failure Indicator
Cowl Flap Position System
Wing Flap Position System
Oil Quantity System
Fuel Quantity System
Anti-Icing Indicator
Tachometer Indicator
Hydraulic Pressure Indicator
Fuel Pressure Indicator
Oil Pressure Indicator
Wheel Position Indicator

Accessories—With current trends toward electrical equipment in modern aircraft, it is extremely important that more consideration be shown the selection accessories than heretofore. Electronic equipment such as that already discussed is operated from a 400-cycle, 115-volt, three-phase power supply, and *it is extremely important that adequate supply be available when it is needed.* It is of equal importance, too, that since much of the new electronic equipment is vulnerable to a phase shift at the power supply, a stable inverter whose past history has proved its worth be selected.

The next consideration from a power supply point of view involves the generator. Here again it must be remembered that the new trends in equipment demand a greater source of direct current than was needed a decade ago. The minimum capacity of the generator to support the d.c. requirements of a modern airplane should be at least 200 amperes.

Companion equipment for these items in the accessory group should be a standby alternator, de-icing equipment, a booster coil, a control panel such as Eclipse type 1539 for good voltage regulation, overvoltage protector, and an adequate circuit breaker. Additional engine items that should be carefully chosen are the starter and a tachometer generator.

The development of items such as those that have been outlined are a tribute to American resourcefulness and engineering ability. Such know-how has made American Aviation the world's best. It has become supreme because of the fact that new innovations have always been introduced primarily for the purpose of making air travel safe. Safety, in the minds of American aircraft engineers, is a prerequisite to good design. Thus, Mr. Executive, these marvelous systems which they have created for your safety will preclude your complete satisfaction when your corporation takes to the air—as it surely must to keep the pace already established by those companies now operating their own executive aircraft.

BOEING XB-52 is the newest Air Force jet bomber. Classified as a long-range, heavy bomber, it is powered by eight jets. The plane has been under camouflage since it was rolled out of the Boeing factory for engine run-up tests. The bomber closely resembles the B-47, although it is a very much larger airplane

Aircraft Insurance

(*Continued from page 33*)

ning and Transportation. The first three perils generally apply to both ground and flight, except fire following a crash. The Transportation peril is that of accident to a conveyance in or upon which the aircraft when dismantled is being transported. Fire and Transportation Coverage is not usually bought as such by "Industrial Aid" accounts.

We mentioned "ground" and "flight." A plane is considered to be "in flight" from the instant the take-off run is started and continuing until the plane has completed its landing run. This definition is important because it is the dividing line between the other two packages of Hull Insurance namely, "All Risks excluding Crash" and "All Risks including Crash" (sometimes called just "All Risks").

"All Risks excluding Crash" names no particular perils; rather it literally covers all perils or risks excepting those involving "in flight" perils. The basic fire, explosion, and lightning follow the ship into the air, except fire following crash. Here the definition of "in flight" comes into its importance. When an owner feels he can take care of "in flight" troubles himself but is dubious about the accidents on the ground where he can't exercise positive control, then this "All Risks excluding Crash" fits his need.

Last, but not least important is the final package "All Risks including Crash." Both on the ground and in flight, the ship is covered against all risks. This is the item purchased by the majority of "Industrial Aid" operators. Of the three coverages available, it is the broadest and requires the largest premium.

Deductibles, Depreciation, Exclusions

What about deductibles, depreciation and exclusions? You can buy just about any deductible that you'd like. There is none usually for basic Fire, Explosion, Lightning and Transportation; likewise, there is commonly no deductible on ground perils and usually a $1,000 deductible for Flight risks on the large multi-engine ships, while single-engine craft take a 2½, 5, or 10 per cent of amount of insurance deductible for both ground and crash. Some companies sell a no-deductible form for large ships and a reduction to $50.00 for the non-moving accidents on ground for the small planes. Generally, the best one to buy is the one which you can carry in relation to the premium.

A depreciation clause is part of most hull policies in anticipation of the normal wearing out and consequent lowering of value of a plane during a policy term. The usual rating for hull insurance by an underwriter considers this factor of a lowering total loss payment as the policy term progresses. Because, at the present time, the values of planes have been steadily rising, buyers of insurance do not want a lowering amount of insurance. To eliminate the depreciation clause is then solely a matter of rate adjustment by the underwriter.

You will find exclusions on any insurance policy. Hull policies today have very few and no company lists any that cannot be lived with easily. Consider them as you would the red lines painted on an instrument glass to show operational maximums. No man can build a plane which cannot be strained apart. Insurance policies likewise have a "voided" point. Exclusions redline this point.

Navy's New Savage

The Air Navy's newest attack bomber is this turbo-prop XA2J-1 *Savage*. Still experimental, the carrier-based attack bomber is powered by two Allison T-40 engines. It is capable of carrying a bomb load of 10,000 pounds and is said to be the Navy's heaviest carrier-based airplane. It was designed by North American.

Liability

Aircraft Hull policies and, for that matter, Aircraft Liability policies, with which we will deal directly, contain a pilot clause by which agreement is reached as to who shall pilot the plane. The use of experienced and well-qualified operating personnel is a key point in the acceptance and rating of an Industrial Aid risk by an insurance company. Its recognition on the policies is a guarantee to the insurer of the continuance of this condition and at the same time clarifies to the insured the terms under which the insurance has been bought. Insurance Companies are obviously very safety conscious. Their requirements for acceptance of a risk are a good indication of what their experience over years has shown to be better aviation practices.

The companion to Hull Insurance is Aircraft Liability Insurance. In a nut shell, it is a service contract to provide legal defense against claims arising out of the ownership, maintenance or use of the aircraft plus a proviso for certain monies to effect settlements with claimants. Because an airplane has an inherent potential for creating much harm and damage, aircraft liability coverage is extremely important to any owner and user.

Modern aircraft liability policies are very broad. Most of them are written on the broader "occurrence" basis rather than the often found "accident" basis of other types of insurance. Besides the specifically named Insured, the pilot and certain other individuals and organizations responsible for the plane's use are automatically provided with protection. By pooling into Groups, insurance companies have made available a wide range of limits for selection by the buyer of the contracts and at the same time have met the flexibility of the aircraft's utility with near-to-the-scene claims service. In short, you can buy most excellent aircraft liability insurance today.

The usual Industrial Aid policy provides for a selection of three basic coverages, two variations in these basics and one supplement to Passenger Liability. The three basics are called—Bodily Injury Liability (excluding passengers), Property Damage Liability and Passenger Bodily Injury Liability. Passengers are set up as a separate group because of the different seating capacities and arrangements of modern planes.

At the time that you select a basic coverage, you also select an amount of money as the maximum for which the insurance company is to be committed via settlement monies and other expense. These selected amounts are "Limits of Liability." Each Basic Bodily Injury Coverage has a limit per occurrence. When you select limits for each basic coverage, you have "Multiple Limits." If you bought one of the variations of the basic coverages, you would get the same coverage but only one limit of liability would be set for the coverages collectively. One variation includes the three basic coverages; the other excludes the Passenger Bodily Injury. These two variations are "Single Limit" coverages.

The supplement to Passenger Bodily Injury Liability is Medical Payments. The prime intent of liability policies of insurance is to protect the insured against loss via legal obligation. Medical Payments steps over the line a bit to provide necessary medical expenses, again to a limit per person, limit per occurrence.

There is a seventh coverage which is available by endorsement or separate contract which is also a supplement to Passenger Liability. It is called Guest Settlement or Voluntary Settlement. Its effect is to pro-

vide certain lump-sum offerings to injured guests to whom the named Insured feels a deeper obligation than is necessary under law.

Most Industrial Aid buyers consider the basic coverages as fundamentals. The problem really arrives with the selection of limits of liability. What limits should be carried? No one can tell you because aviation experience has not yet created enough claims to permit determination of what might be called "decent" limits. The answer seems to be to play for safety in high limits. If you arrive at this conclusion, you will find very high limits available to you. They are carefully underwritten, as you can imagine they should be when millions of dollars are placed on the line.

Aircraft Liability Policies contain exclusion sections just as hull policies do. Once again, there are red lines to indicate how far the insurer will go before denying liability. Like hull, no modern Aircraft Liability forms contain any exclusions which cannot be complied with easily.

Under the general heading of Aircraft Liability insurance comes one other type of contract called Corporation Non-Ownership Liability Insurance. Written along the general lines of owned-aircraft policies, it covers the Named Insured Corporation or company and executives and directors while acting as such as they may be held accountable under employer-employee responsibility laws for damages or injuries arising out of the use of non-owned airplanes. Concerns carry similar insurance as regards automobiles—you can also have like coverage as regards aircraft.

Workmen's Compensation

Aircraft Hull and Liability insurance take care of the plane and public. Other means are necessary to include the aviation hazards in the usual company workmen's compensation and executive protection plans.

The broadness of a normal workmen's compensation policy will cover employees who ride as passengers in the employer's planes. With respect to aircraft crews, special rates apply to cover the further exposure. Most insurance companies are willing to include the crew's exposure in the policy of workmen's compensation for the other employees.

Many employers feel that employees operating or flying in company ships deserve voluntary protection over and above statutory compensation. These buyers either effect accident policies for particular individuals or for groups of employees or purchase Guest Settlement or Voluntary Settlement coverage which will apply to employees including pilot. Still others have Medical Payments coverage modified to provide certain allowances in excess of the medical expense recoveries allowable under the company's compensation policies.

In attempting to arrange insurance for your aviation risks, you will find that with the exception of workmen's compensation and certain types of accident insurance, none of the coverages described have any set price tags. Workmen's compensation insurance has its rates set by the applicable state Compensation Board's experience while aviation accident covers are rated from the board experience statistics developed by accident companies. As for hull and liability aircraft policies, the price tags or premiums are custom made for each risk by the underwriters. This latter situation is not the answer to costs in a survey, but let's proceed through it to something more concrete.

Insurance Costs

Aviation insurance on hulls and liability in the United States is about 30 years old. Prior to that time some insurance, but not very much, was written in foreign countries. Throughout the entire time, the headache for companies attempting to write the business was to get enough premium to pay the loss which aviation, by its very nature, was going to cause. That charge also had to be one which the insureds could and would pay.

During this period also, many attempts were made by various companies to prepare rating schedules whereby all the different types of risks could be fitted for insurance easily and without individual examination. At the same time, other underwriters took a different view and treated each risk as a unique entity to be carefully evaluated and rated. The result today is the survival of those who underwrote most carefully and the absence of those who tried to group risks into narrow rate lists which were good for anyone who came under the class of business. Because experience has proved the only way to be able to provide aviation insurance is to underwrite very carefully, you must provide certain information about a plane, its use and crew to obtain price for coverage.

Aviation insurance is also a competitive business and underwriters do not all arrive at the same rate after evaluating the same risk. Accordingly, various "quotes" are usually obtained from different underwriters. For the usual Industrial risk you will find the hull quotes from all the underwriters will be very close. There is keen competition but there is also that business know-how which permeates companies' use of planes and labels the usual Industrial Aid account as a generally recognized better risk.

As to initial outlay for hull insurance, you can very roughly estimate a regular All Risks policy on a fine twin-engine plane to cost about 4 or 6 per cent of the value of the ship. If it's an amphibian, it will cost more to take care of the water hazards. What you may consider as a "fine" ship, may also be one for which parts are not readily available. For the partial loss potential for such a ship, you can expect a differential in rate. The All Risk excluding Crash policy will cost anywhere from 30 to 60 per cent of the All Risks rate. Remember, there are certain fixed costs to produce an insurance policy and, therefore, the difference between the All Risks excluding Crash and the All Risks rate is not completely the measure of the Crash exposure.

We will skip Fire and Transportation rates since this coverage is seldom bought.

Single-engine planes have rates which are not so easy to indicate. There are a wider variety of single-engine planes not only design wise but also as to value, speed, range, etc. All Risks hull insurance can cost anywhere from 7½ per cent to 20 per cent of the insured value for single-engine planes. Generally, the heavier, higher valued, newer and better equipment receives the lower rate while the older, more vulnerable, less valued and less steady come into higher rating. All Risks excluding Crash rates are no easier to give but they follow the twin-engine in being 30 to 60 per cent of the All Risks rate.

To find out what the aircraft liability premium will be for a particular risk, you have to submit particulars to the underwriters just as you do for the hull quotations. Once again, you will get different quotes from different underwriters, depending upon their valuation of the facts which you have given. It is difficult to give dollar and cents figures for the various coverages because there are six coverages and there are various limits available for each. If you happen to own a five-passenger airplane and you bought the lowest limits available for the three basic coverages of Bodily Injury excluding Passengers, Property Damage and Passenger Liability, the premium would be approximately $140.00. In contrast, if you purchase the highest limits available for these three basic coverages, the premium would not be over $2,000.00, and that would be high. Somewhere in between these two figures is the premium cost for the majority of industrial aid buyers today. We must apologize for not being able to give more accurate figures but there are too many variations in limits to permit specifics here.

We mentioned Guest Settlement or Voluntary Settlement as a supplement to Passenger Liability Coverage. The risk being otherwise insured, the rate per $1,000 of limit is between $4.00 and $9.00. The nature of the equipment and use sets the specific rate in the general bracketing.

For all that has been said about Aviation Insurance, there is much more that can be said. Aviation Insurance like the activity it applies to is going to change. For the present, this is a still picture for those who may want to buy Industrial Aid Insurance.

PICTURE CREDITS

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. . . Your Flight Engineer

(*Continued from page 17*)

The flight engineer is a busy man. And a brief outline of his duties shows why.

First of all, he works with the ground crew to see that fuel is properly loaded and that plane servicing is done efficiently.

Next he's responsible for a pre-flight inspection so exhaustive that the check list covers seven pages in the TWA crew manual. Among the many parts he must examine in addition to the engines are tires, lights, antennae, cabin pressure regulator valves, main gear and wheel wells, propellers, control and tail surfaces.

When these—and a dozen others—have been inspected, he checks the cabin and cockpit, making sure that everything is ready and in place.

As flight time draws near, the flight engineer really gets busy. The take-off demands the coordinated skills and experience of the entire crew, rhythmic human teamwork that is almost as essential to flight as the rhythmic mechanical movement of the engines.

At his station behind the co-pilot's seat, the flight engineer waits for orders from the captain, then starts up the engines individually, beginning with the Number 3 engine and following with Numbers 4, 2, and 1. Number 1 is the left outboard engine; Numbe 2, the left inboard engine; Number 3, the right inboard engine; and Number 4, the right outboard engine. The engines are started in this 3-4-2-1 sequence for a good reason: the hydraulic pumps for the brakes are located in the Number 3 engine, so by starting that one first the pilot immediately has hydraulic pressure for the brakes.

Each of the *Constellation* engines is equipped with a starter switch, something like the push-button on a modern automobile. By touching the button—and turning on the fuel at the proper time—the flight engineer brings each engine to life, roaring with power. The flight engineer then controls the engine run-up and watches the output of each engine for any irregularity. From then until the end of the flight, his eyes continually sweep his instrument panel, scanning the myriad dials and gages.

In the *Constellation* all the engine instruments are centralized on the engineer's panel. Duplicate sets of throttles, manifold pressure gages and tachometers, as well as switches controlling the propellers, are located on both the flight engineer and pilot panels.

Seated at his mechanical console, he watches 63 per cent of the *Constellation's* 680 flight controls and instruments. Thus, while the engineer supervises the mechanical requirements of the flight, the pilot and co-pilot are free to concentrate on the actual guidance of the airplane.

A practical man who doesn't believe in attempting the impossible, the flight engineer never reads the instruments individually. Instead he keeps track of them by noting the relative positions of the indicators. Because their correct pattern is second nature with him, he can instantly spot any variation from the normal.

During the climb, the flight engineer is the "foot on the accelerator," pouring on the power as the captain requests it. He controls the richness or leanness in the mixture of air and gasoline, the pitch and revolution of the propellers, the engine-cowling flap switches. He also has charge of oil temperature and carburetor heat controls.

While the plane cruises, the flight engineer keeps up the required power output, watches the utilization of fuel in proper tank sequence, and keeps a logbook of engine performance. He steadily monitors the panel, watching oil and pressure gages, alcohol and hydraulic systems, tachometers and thermometers and all the rest.

Sometimes called an "aerial Hawkshaw," the flight engineer is alert for all "clues" to the safe operation of the airliner. His check-and-double-check procedures make him a liaison man between TWA's mechanics on the ground and the pilots in the air.

In addition to his other duties, the flight engineer is also the weatherman who controls the climate inside the *Constellation*, for heat, ventilation and cabin pressurization all come under his supervision. Although the *Constellation* flies at 20,000 feet, the pressurized cabin maintains an 8,000-foot altitude. As the plane comes in for landing, the FE keeps an eye on the automatic controls to see that the cabin rate of descent does not, normally, exceed 300 feet a minute.

During the landing, he works again at the discretion of the captain in adjusting the fuel mixture, propellers, engine blowers and crossfeeds. Once the plane is on the ground, the engineer gives the ship a final check.

Even an earthbound novice needs no second sight to realize that flight engineering requires well-trained, well-qualified technicians. Consequently, the requirements and training for the job are stiff. The candidate must hold a CAA mechanic's certificate with aircraft and engine ratings, be able to meet the basic physical requirements for TWA flight personnel, have a high school education or the equivalent, four years of experience in the maintenance and repair of aircraft and aircraft engines, or one year of practical experience plus an engineering degree from a recognized college.

Also, the applicant must pass an aptitude test and an interview at the TWA flight engineer offices in Kansas City. Before his employment by the airline, he must also pass a CAA written examination. Applicants must be between the ages of 21 and 35.

TWA maintains its own flight engineer training program, using a staff of 12 full-time instructors. The average class at the school, located in Kansas City, includes about 12 students.

The training program, from four to six months, depending upon the number and experience of the students, is divided into three phases. The first is a thorough basic course covering flight computation, airplane performance, engine performance and operation, applied physics, aircraft electronics and flight-engineer duties.

Running approximately one month, this basic course serves three purposes: to provide a transition from ground to flight; to bring all members of the class to a common level of experience and knowledge; and to acquaint them with the terminology of their new profession.

Equipment training, an eight-week course, is the next phase of the program, concentrating on aircraft mechanisms. The class makes a piece-by-piece study of the *Constellation*, using cutaways of the engine parts, mock-ups of electrical, hydraulic and heating systems, and sometimes individual units removed from the ship for examination.

Besides the mock-ups and cutaways, instructors also use motion pictures, slides and photographs to familiarize the students with the miscellany of mechanical parts. Classwork is also supplemented with practical

(*Continued on page 60*)

BRISTOL SYCAMORE 10 is ambulance version of the Bristol 171 helicopter. To house stretchers, two "Perspex" blisters are used, one on each side of the fuselage. These are detachable and can be replaced by ordinary paired units when the 'copter flies as a normal four-passenger transport helicopter

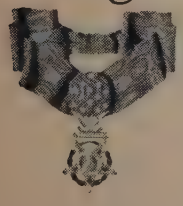
THE LONG AUGUST NIGHT WAS HOT—but not as hot as the bitter fighting that raged about Agok, Korea, in the Naktong River area. Sergeant Kouma, serving as tank commander, was covering the withdrawal of infantry units from the front. Discovering that his tank was the only obstacle in the path of an enemy breakthrough, Sergeant Kouma waged a furious

nine-hour battle, running an eight-mile gantlet through enemy lines. He finally withdrew to friendly lines, but not until after his ammunition was exhausted and he had left 250 enemy dead behind him. Even then, although wounded twice, he attempted to resupply his tank and return to the fighting.

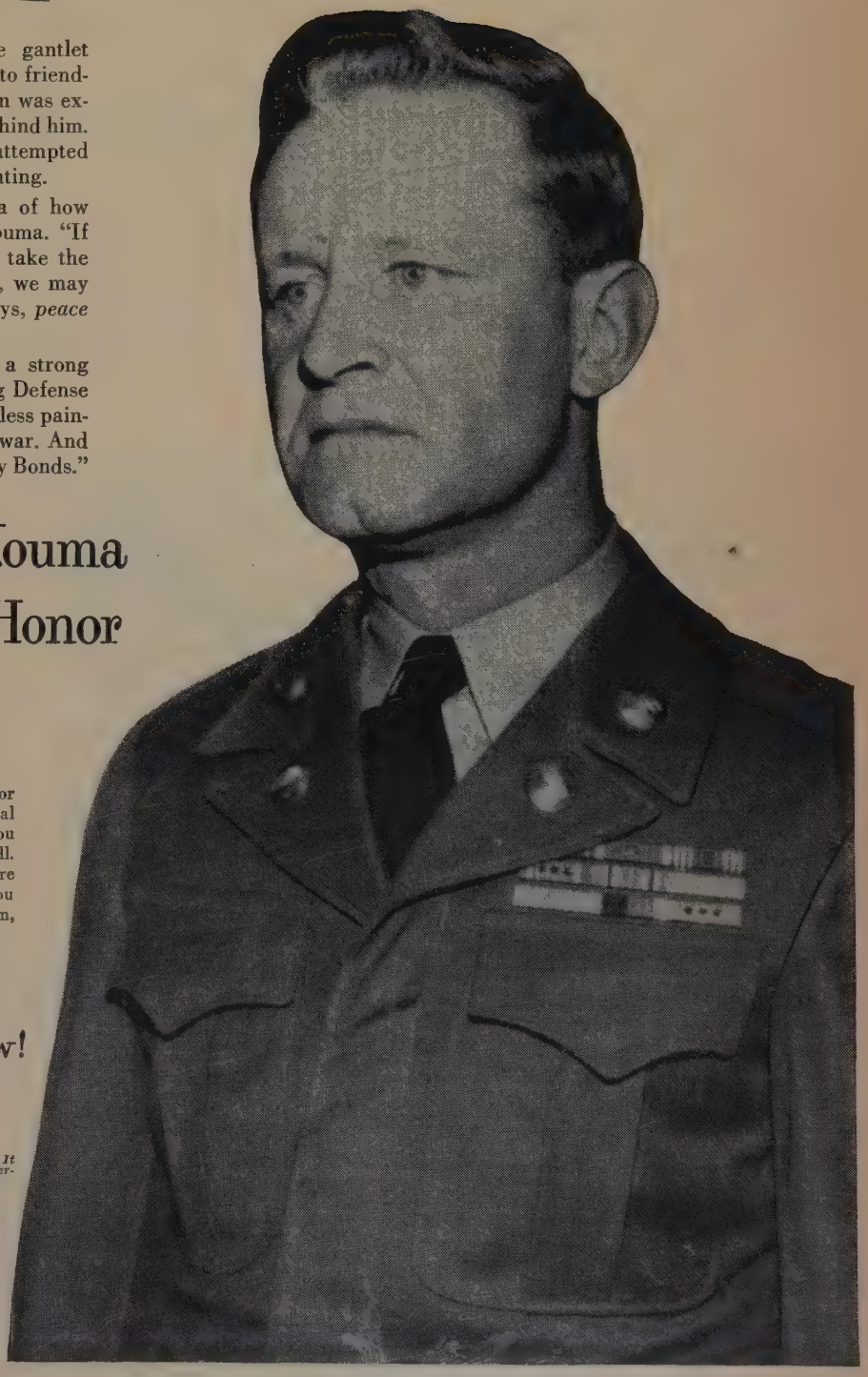
"A withdrawing action is not my idea of how Americans should fight," says Ernest Kouma. "If we must fight, let's be strong enough to take the offensive. In fact, *if we're strong enough*, we may not have to fight at all. Because, nowadays, *peace is for the strong.*

"So let's build our strength—to keep a strong America at peace. You can help by buying Defense Bonds—as many as you can afford. It's far less painful to build for peace than to destroy in war. And *peace* is what you're building when you buy Bonds."

M/Sgt. Ernest R. Kouma



Medal of Honor



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Care and Caution . . .

(*Continued from page 28*)

irregularities. The metal should be removed by starting at approximately the thickest section, and working forward over the leading edge camber so that the contour of the reworked portion will remain substantially the same. In all cases, avoid abrupt changes in section or blunt edges. Diagram (*page 28*) will aid in depicting the foregoing.

Propeller overhaul, even at long intervals, further cuts down blade life if you permit the practice of heavy blade grinding preparatory to a mirror finish. This looks pretty, but it's unnecessary in that you remove a lot of irreplaceable material. Next time your props are in for overhaul, talk to the shop foreman about an "airline" or "bush-pilot" finish. This finish, originating some years ago at the behest of operators utilizing poorly maintained runways resulting in abbreviated and expensive blade life, "skins off" the face and camber blade sides to a minimum depth by grinding, but makes no effort to uniformly remove metal to completely eliminate all pits and dimples. A good rule to follow here is to uniformly remove material *only* to a depth where those average abrasions remaining in the blade are no deeper than .005 inches. Naturally, remove the scattered deeped abrasions locally. A buff or satin finish, then applied, while not as pretty to the esthetic, is just as airworthy and certainly cheaper as it takes far less labor than that required to lay on a good mirror finish.

Another "must" in the line of preventive maintenance is the periodic desludging of the propeller dome. Since the Hamilton propeller utilizes engine oil as its operating medium, all the engine-generated sludge or "slush" has a direct route to the propeller dome. This acts as an excellent "sludge pot" and it is very common to note extremely heavy build-ups on the dome shell walls and piston. Since the propeller piston moves within the shell much in the manner of an engine piston in its cylinder, such deposits, by creating unequal pressure demands from the governor, frequently are the cause of poor synchronization. Of even more importance, it is possible for it to build to the point where "feathering" is hampered by creating a sufficient pressure requirement to "pop" the feathering switch in the cockpit before the blades have reached the proper angle. No set recommendation applies to the intervals between desludging as no two operators ever seem to use identical oils, operating conditions, engines, etc., which generate the sludge. Two methods seem widespread for ridding the dome of troublesome sludge, the first and easiest of which is occasional feathering.

During the feathering cycle, the dome piston moves to its extreme travel in the dome shell; since sludge builds on these undisturbed surfaces during normal operation, feathering serves to break it loose and dump it back into the engine upon unfeathering. This practice, although extremely common, may be deleterious to the engine if not routinely practiced. One operator of R-1820-equipped DC-3's swears to this day that several engine failures were caused by dumping extremely heavy sludge deposits back into the engine nose, clogging significant oil passages. It would appear, therefore, that those operators suffering heavy sludging combine periodic practice feathering with occasional dome removal for a good clean out. It is impractical, here, to recommend any period for this clean out due to widely varying experience; certainly dome removal at 200 hour intervals will satisfy the majority of operators' conditions.

Since the Hamilton propeller is filled with oil, leakage is not uncommon. Such leaks are generally confined to the propeller blade packings, dome to barrel seal and spider to shaft seal, and generally appear after a long period of usage when the seals deteriorate in effectiveness through aging as well as through the presence of foreign material between seal and sealing surface. Little can be done about the aging characteristics, although we will put in a plug here to keep away from seals which are suspect to extremely long storage periods. It may cost a bit more to procure new ones, but the investment is small in comparison to "fixing a leak." If you're confronted with blade seal leakage, a good trick to try is the insertion of a .002-inch feeler gage between blade and seal. Oftentimes the seal has stuck to its sealing surface and freeing it will be all the cure required. Another point to ascertain is whether slight leakage warrants attention. For example, newly installed propellers frequently show a trace of leakage due to the presence of residual oil on the parts as well as that leakage occurring prior to proper seal seating. Additionally, in cold-weather operation, on start-up after a gasoline dilution engine shutdown, leakage may show up due to the presence of gasoline in the oil. After the gasoline burns out, such leakage will generally disappear. Oh yes, while we're talking about gasoline dilution, it's wise to partially feather and unfeather the propeller several times toward the end of the dilution run to protect it as well as the engine against the cold. This partial feathering takes gasoline diluted oil from the engine oil tank and disperses it to the feathering line, governor and propeller.

Some additional thoughts on trouble shooting are summarized below.

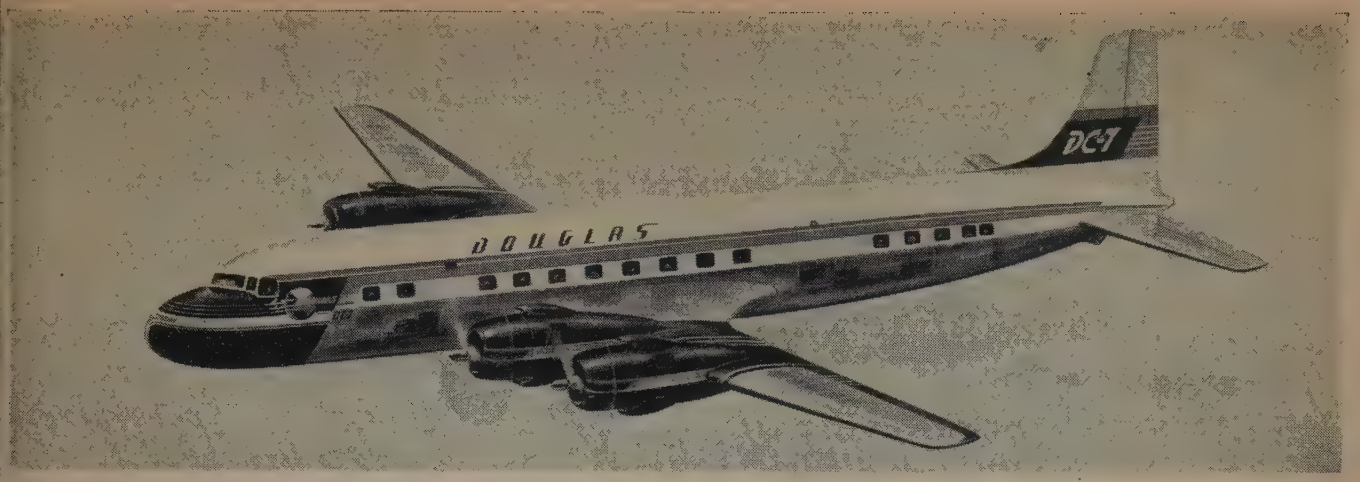
OVERSPEEDING ON TAKE-OFF

Probable Cause	*Remedy*
Wrong setting on governor.	Reset governor.
Insufficient exercise of propeller mechanism prior to take-off.	Move control several times through constant-speed range with engine running.
Too rapid opening of throttle.	Advance throttle evenly and slowly.
Damaged gasket between distributor valve and propeller shaft.	Install correct new gasket.
Damaged or incorrect gasket between governor base and engine mounting pad.	Install correct new gasket.
Sticky governor pilot or relief valve.	Disassemble and clean.

(*Continued on page 60*)

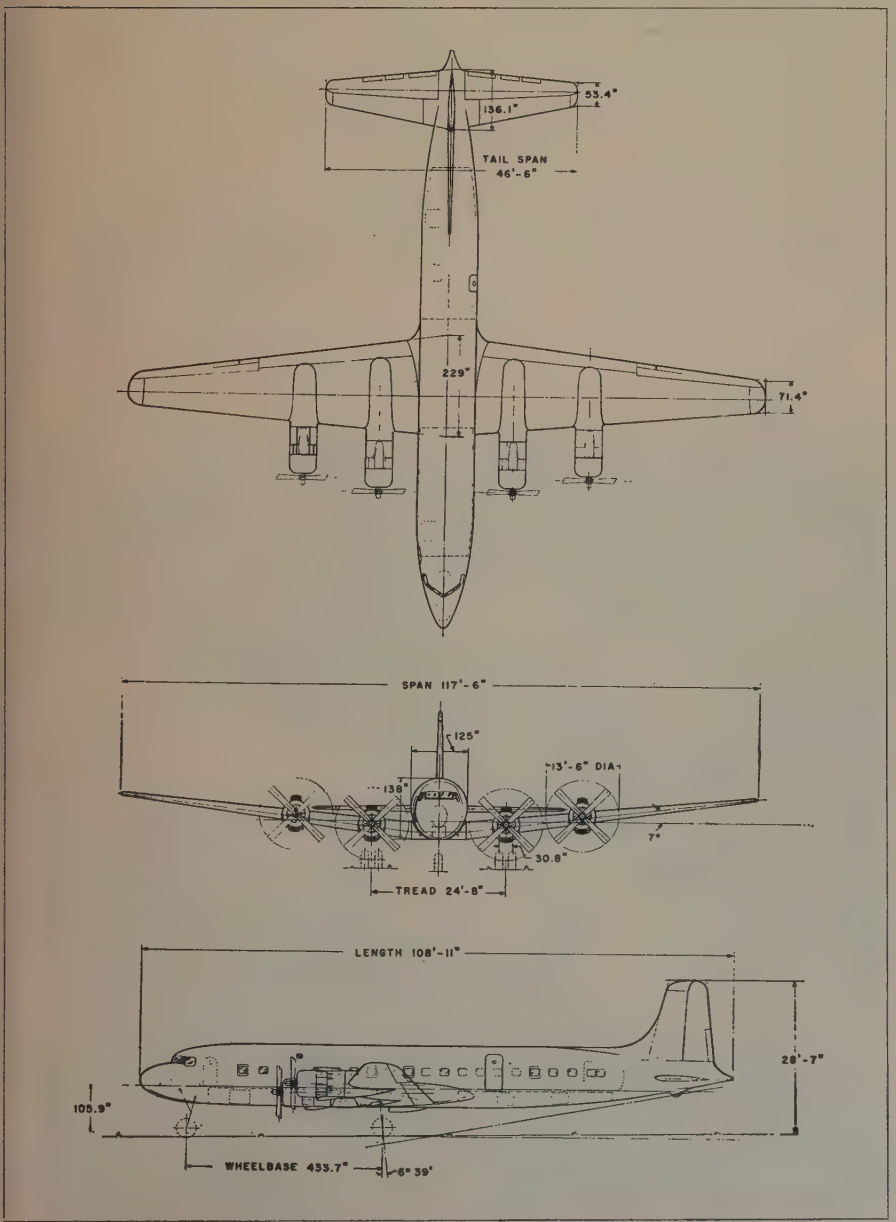
Auster Freighter

Auster B4 is a multi-purpose airplane that by simple modification can be adapted for a wide variety of roles, *i.e.* cable laying, supply dropping, ambulance duty, etc. It is powered by 180-hp Cirrus engine, cruises at 100 mph. In the photo the plane is delivering a bundle of newspapers



DOUGLAS AIRCRAFT is building new DC-7 luxury airliners; first 25 ordered by American Air Lines to go into coast-to-coast service in 1954

Douglas Announces New DC-7



WITH the announcement of the new DC-7, the Douglas Aircraft Company gains the speed edge in the "race" between commercial airliner builders. The DC-7 offers a cruising speed 50 mph faster than that of the DC-6. An evolutionary development of the "six," the new DC-7 will have a top speed in excess of 400 mph and a normal cruising speed of more than 360 mph. It will be powered by four Wright compound engines delivering a total of 13,000 horsepower at take-off, compared with the 8400 horsepower of the DC-6.

The turbo-compound engine is one which utilizes the energy of exhaust gases to operate three auxiliary turbines. These in turn are geared back to the engine crank shaft to provide greater horsepower without the additional expenditure of fuel. Many designers and engineers feel that the compound-engine-powered airliner will be an interim airliner to fill the speed gap between reciprocating-engine-powered airliners and the pure jet airliner of the near future.

The new DC-7 is more than eight feet longer than the DC-6, and will accommodate from 60 to 95 passengers, depending on seating arrangement. Automatically controlled air conditioning and pressurization in the cabin will provide sea-level atmosphere at a flight altitude of 12,500 feet, the equivalent of 5,000 feet at an altitude of 20,000 feet, 8,000 feet when the plane is at 25,000 feet.

Two versions of the DC-7 will be produced: one for domestic airlines and one for long-range overseas operations. The domestic transport, carrying 4,512 gallons of fuel, will have a gross take-off weight of 116,800 pounds. The overseas model will carry 6600 gallons of fuel.

The DC-7 recently was ordered by American Air Lines, and Douglas is at work on the first of 25 DC-7's which American expects to put into service early in 1954.

LUXURY LINER DC-7 will carry from 60 to 95 passengers. It has wing span of 117 feet 6 inches, over-all length of 108 feet 11 inches, dual-type gear

. . . Jet Personal Planes

(*Continued from page 19*)

half-discs in rows on each wing, situated about one third of the chord back from the leading edge. The cockpit canopy is a frameless perspex moulding and the Turboméca *Piméné* is mounted just behind and above it, exhausting over the rear fuselage between the halves of the *Bonanza*-style butterfly tail assembly. The *Piméné*, which weighs only 92 pounds bare, has a maximum take-off thrust of 220 pounds, and gives a continuous thrust of 176 pounds, with a specific fuel consumption of 1.08 lb/hr/lb thrust. Fuel tanks holding 26.4 U. S. gallons are accommodated in wings and fuselage, and a monowheel undercarriage is employed with skid shoes fitted to the undersides of streamlined wingtip fairings.

Successful trials with the *Piméné*-powered *Sylph* led to the development of a higher-powered and refined machine known as the *Cyclope*. Although similar in basic concept to the earlier model, the *Cyclope* has a wing of broader chord and considerably reduced span, and a levered-suspension nosewheel supplements the single main wheel. Powered by a Turboméca *Palas*, which gives 330 pounds thrust at take-off, weighs 40 pounds more than the smaller *Piméné* and has a continuous thrust of 304 pounds at a specific consumption of 1.12 lb/hr/lb thrust, the *Cyclope* flew for the first time in April. Spanning 29 feet and having a length of 22 feet, the *Cyclope* has a wing area of 106 square feet and an aspect ratio of 7.7 : 1.

Weights and performance figures for the *Cyclope* as compared with those of the *Sylph* (the latter in parentheses) are as follows: Empty weight, 944 (760) pounds; loaded weight, 1,371 (1,200) pounds; maximum speed, 217 (165) mph; initial climb rate, 1,516 (787) feet per minute; ceiling, 29,527 (27,887) feet; range, 187 (143) miles; take-off run to clear 65 feet, 984 (1,378) feet.

Graduating from the single to the two-seater, the Fouga company next produced the C. M. 88-R *Gemeaux* I, which employs the twin-fuselage structure of the *Castor* and *Pollux* gliders and is intended primarily as a personal plane, although later versions of the *Gemeaux* are being used as flying test-beds for various jet units in the Turboméca range, and to investigate various operating problems.

The twin fuselages of the *Gemeaux* I are joined by a wing center section and a single bracing strut under the tail assembly, and each fuselage carries a single cockpit, *à la Twin-Mustang*, and all controls and instruments are duplicated so that the airplane can be flown from either cockpit. VHF radio and R/T are installed, the all-wood structure is an improvement on that of the *Cyclope*, and a fixed four-wheel landing gear is fitted. Power is provided by two *Piméné* turbojets installed one above each fuselage to the rear of the cockpits. General details of the *Gemeaux* I are as follows:

Span, 35 feet 8 inches; length, 22 feet; aspect ratio 9.1 : 1.; empty weight, 1,595 pounds; loaded weight, 2,381 pounds; top speed, 205 mph; initial climb rate, 1,083 feet per minute; take-off run to clear 65 feet, 1,960 feet; maximum ceiling, 31,168 feet; range at 13,123 feet, 187 miles.

Later versions of the *Gemeaux*, intended purely for research purposes, have a single turbojet installed above the wing center section. These include the *Gemeaux* II, III, IV, and V, powered by the *Marboré* I, *Marboré* II, the *Aspin* I and *Aspin* II respectively.

Light jet airplanes have obvious military applications and the French Air Ministry was not slow in seeing their potentialities as high-speed liaison airplanes, economical pilot trainers and light ground-attack machines. Two development contracts have been placed by the Ministry with Fouga for two light twin-jet trainers, the two-seat C. W. 170-R and the single-seat C. M. 821-R. The C. M. 170-R will be a very clean-looking tandem two-seater with two 840-pound thrust *Marboré* II units mounted close to each side of the fuselage. Top speed of this airplane is estimated at 372 mph. The single-seat C. M. 821-R will be similarly powered and will have provision for 12 rocket projectiles and one Hispano-Suiza 404 M.49 cannon with 200 rounds of ammunition.

As a three-quarter scale flying model of the C. M. 821-R, Fouga has built and tested the C. M. 82-R *Lutin*. The *Lutin* follows the general lines of the *Sylph-Cyclone* series, has the characteristic butterfly tail assembly and the spoilers working through slots in the wing upper surfaces, but is powered by two Turboméca *Palas* units mounted in self-contained pods under the wings instead of by a single unit mounted on the fuselage behind the pilot.

The throttling system employed by the *Lutin* is new and consists of a three-position electric switch. When the switch lever is forward, the engines are being accelerated at the highest rate permissible; in the central position the switch holds the engine revs constant, while with the switch in the rear position the engines are throttled back. Electrical leads connect the throttle to the pilot's control switch, the electric motors being mounted in the pods. Among the few particulars of the *Lutin* available is a designed top speed of 310 mph.

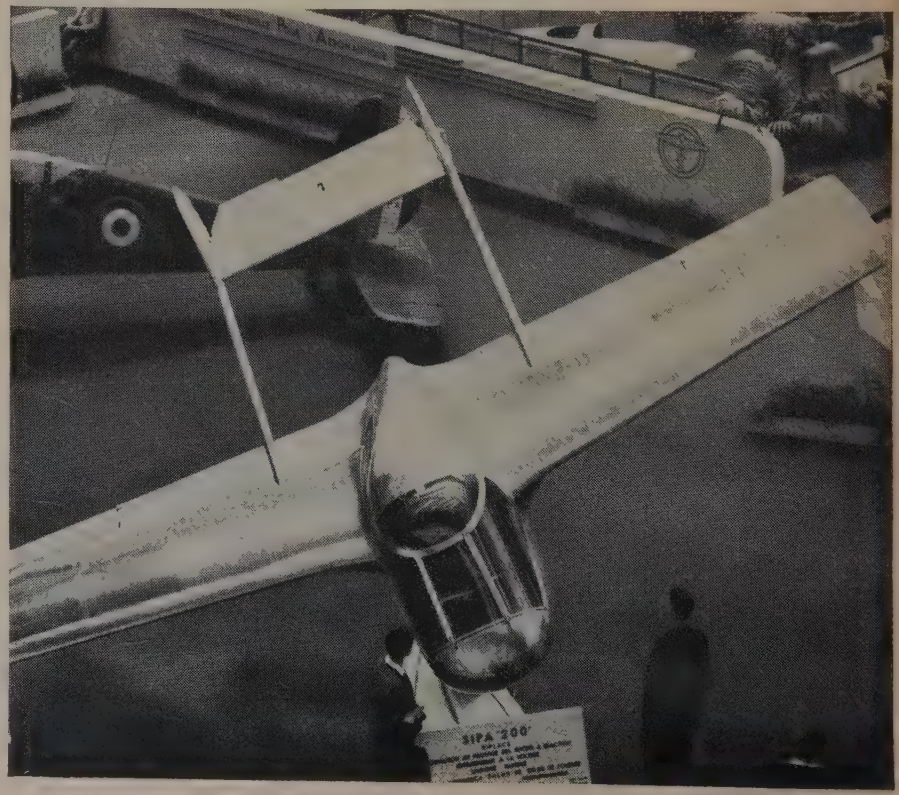
Another official development contract has been placed with the S.I.P.A. company for a light jet trainer and liaison monoplane. Known as the S.200, the attractive little monoplane that has resulted from this contract is also a potential personal plane. Basically an all-metal mid-wing monoplane with side-by-side seats in a central fuselage nacelle, which also houses the single *Palas* turbojet, the tail unit of the S.200 is carried on unusually slim tail booms.

The wings, which span 23 feet 6 inches, are of laminar-flow type and are fitted with high-lift flaps. Two prototype S.200 monoplanes have been built and estimated performance includes a top speed of 267 mph at sea level, a top cruising speed of 236 mph at 3300 feet, a range of 300 to 370 miles, and a ceiling of 26,250 feet.

From the progress made in France, it doesn't look like a very long haul to the point where the gas turbine will push aside the piston engine in many small planes. Fuel consumption still presents some problems, but many personal flyers do hanker to fly a jet, and there will be a ready market awaiting such airplanes as these.

SKYWAYS' Correspondent in Great Britain, William Green, brings to readers next month a detailed article on experimental and prototype jet fighter planes from W. Europe.

SIPA S.200 was first displayed at Paris Aeronautical Exhibit. It is a two-place side-by-side jet liaison monoplane that has 267-mph top speed and cruises at 236 mph at 3300 feet



Dilbert

(*Continued from page 37*)

the Atlantic seaboard where German submarines were sinking our ships at an alarming rate. Using small private airplanes, these civilian volunteers, many of whom were over-age or otherwise exempt from military service, began hunting these subs.

They found them, too, 173 of them. Many of the subs were destroyed by military aircraft summoned to the scene by CAP. Believe it or not, these civilians attacked 57 of the subs themselves with small bombs and depth charges, and are credited with six sinkings. These important contributions were paid for in full: 50 men and 150 planes were lost by CAP in these voluntary military missions.

CAP so proved its worth during the War that it now plays a major role in our defense plans. In 1948 Congress passed a law making this civilian organization an official auxiliary of the Air Force. Its members are authorized to wear the Air Force uniform, with only minor changes.

The Air Force directive has assigned the Civil Air Patrol these major military and civilian tasks:

1. Build up a Cadet Corps of 100,000 boys and girls.

2. Maintain air and ground units to aid anti-submarine patrol around the United States and its possessions, and participate in air rescue work of the Military Air Transport Service.

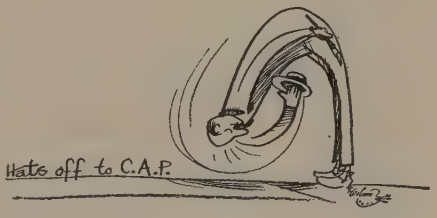
3. Develop an auxiliary radio communications network in the U. S. and its possessions.

4. Assist in civilian disasters by evacuating personnel, or helping to supply people who may be isolated by storm, flood and other disasters; or otherwise aiding in relief work.

As an example of relief work during civilian disaster, take the blizzard in the Rocky Mountain states two years ago. CAP flew 184 planes for a total of 1400 hours, and dropped more than 23 tons of supplies during this emergency—and with very little fanfare. They didn't all return from that mission, either.

Today CAP has approximately 4,000 planes at its command, either loaned, donated or owned by its pilots. CAP now consists of 34,000 senior members, more than 13,000 of whom are rated pilots. In addition, there are over 40,000 cadets, boys and girls 15 to 18 years old. They are taught by senior members in pre-flight courses or in aviation auxiliary subjects, such as radio communications and weather forecasting.

Would you like to belong to a swell organization and have that feeling of satisfaction in doing something really worth while? Look up your local Civil Air Patrol; there's an active Wing in every state and territory. Principal qualifications are the adventurous spirit of a volunteer fireman, plus a spark of patriotism. HAPPY BIRTHDAY, CAP.



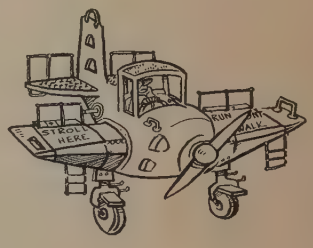
Don't Push Here—One way to make airplanes last is to make the engines first. (Sorry, couldn't help that one.) Fortunately, there's another way to make them last, and that is to *take care of them.*

You could write a book on this subject. Pending that, here are a few well-known but oft-neglected reminders on ground handling:

DON'T

1. Walk upon surfaces where "stop" areas are not provided.
2. Lift the tail of your airplane by placing your shoulders under the tail surfaces.
3. Push or pull the airplane at tail surfaces, trailing edges of wings, or external brace wires.
4. Neglect to secure control surfaces when airplanes are parked, to prevent buffeting.

Of course, the manufacturer *could* beef up these areas to withstand any abuse, only then you would have a truck instead of an airplane.



Oh, What You Said!—It was a beautiful day for flying. Beautiful weather, however, doesn't necessarily make one fly that way. Proof of this was a student flying instruments under the hood. To put it mildly, he was experiencing a bit of difficulty.

Finally, becoming exasperated, he picked up his mike to speak to his instructor in the front cockpit. He was so upset that he failed to notice he was "on the air" instead of just talking to his instructor.

"Sir, I'm —— —— ——'d up. Please straighten me out. Then may I start over again?" he inquired.

No sooner had he finished speaking than the tower butted in, "Unidentified plane using profanity and obscenity, what is your identification?"

Nothing but startled silence from the student for a moment. Then his quavering reply, "Sorry, I'm not that ——'d up!"

SETH'S SAFETY QUIZ

1. You are flying VFR and run into heavy weather. What maneuver should you execute?

2. What is the biggest single cause of aircraft accidents?

3. What two pilots errors cause most of the forced landings during simulated emergencies?

SAFETY QUIZ ANSWERS

1. What else but a 180° turn.
2. That old bogy—Pilot Error.
3. a. Allowing engine to cool off and foul up through failure to blimp it.
   b. Too rapid application of throttle, causing engine to choke up.

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BONANZAS: 30 from $6250. Painted late 1949, #8004AS, has 500 hours. Overhauled engine. Late improvements. Extras. Bargain. $9000. Also; brand new crated painted 1951 C-35, #1088, with extra tank, gyros. VHF, ADF, and extras. $21,500. Make offer. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

EXECUTIVE Twin Beech 18D in excellent condition, licensed for 8, reclining airline seats, VHF radio, ADF, 125 hours since overhaul. Spare engine majored, painted, 206 gallons, $29,000.00. Jack A. Rodgers, 1400 Archwood Avenue, Akron, Ohio, Princeton 5131.

BELLANCA

CRUISAIRS: 14 available. Late 1946, #81787S, has all 1947 features. 36 hours since overhauled. Aeromatic. Gyros. Radio. Bargain. $3100. Also; 1949, #6018NS, with 173 hours. Aeromatic. Primary blind. Radio. New condition. $4750. Apply POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

CRUISEMASTERS: 3 from $10,500. 1951 #583AS, has only 40 hours. Auxiliary tank. Gyro. ADF. Extras. New. Bargain. $12,000. Consult, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

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170'S: 20 available. 1948, #2075S, has 282 hours, engine 238 hours. Metal propeller. Primary blind. Radio. Very clean. Bargain. $3325. Also; 1949 all metal, #3368VS, with 517 hours, engine 221 hours. Metal propeller. Primary blind. Omni-range. Excellent. Bargain. $5000. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

195'S: 10 available. 1950, 245HP, #9340AS, has 267 hours. Gyros. Excellent. $10,950. Make offer. Also; 1951, 245HP, #1536DS, with only 57 hours. Gyros. New. Bargain. $12,195. Apply POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

TWINS: 19 from $1600. Executive, #5612NS, was recovered 1949. Engines 400 and 145 hours. Propellers 150 hours. Outside baggage door. Landing lights. Gyros. ADF. Reupholstered. Exceptional. Bargain. $2500. Consult, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

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GOOSE AMPHIBIANS: 2 available. 1944 seven passenger airliner #104S, had new hull 1948. 412 hours since completely overhauled. Airline instruments and radio. Excellent. $45,000. Consult, POWERS & GEORGE. Aircraft Brokers, 475 Fifth Avenue, New York City. "Airplanes Everywhere".

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(*Continued on page 60*)

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(*Continued from page 59*)

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. . . Your Flight Engineer

(*Continued from page 52*)

demonstrations on training flights, with the students spending about one-third of their time in the air.

Flight training is the third and final step in the engineer's education. In this phase, students roll up a backlog of flight time, from 10 to 65 hours, depending upon previous experience. For training flights, student engineers go up with TWA's regular check crews which test-fly every airliner after it has had a periodic overhaul at the base in Kansas City, Kansas. Under the supervision of the three flight engineers assigned to these test crews, the student goes through his regular duties, performing them over and over again to get the necessary practice.

Before he is checked out as a regular crew member, the flight engineer undergoes one of the most rigorous examinations required of any student—the blindfold test. On one of the training flights, the student, wearing a blindfold, must go through the 127 operations connected with his job. This is proof—solid enough even to satisfy the diligent instructors—that selecting the right control at the right time is second nature to the new engineer, that he can literally see his complicated instrument panel with his eyes closed.

The blindfold test led to one of the flight engineers' most reliable shop-talk stories. Like other training procedure, the test is made on a special flight—one of the post-overhaul trips, carrying no passengers—and one afternoon, when the crew was getting ready to take off, a non-flying visitor at the TWA Base saw a flight engineer being fitted into his blindfold.

"But how odd!" exclaimed the befuddled visitor. "There's not a cloud in the sky—what are they flying blind for?"

Well, it may be apocryphal at that.

After passing the blindfold test, the written examination and a practical examination, the student is ready to go out "on the line," taking with him the tools of his trade: flashlight, wrench, two screw drivers, two pairs of pliers, a crescent wrench, a pair of diagonals, safety wire and friction tape.

His education doesn't end, however, when he goes to work on regularly scheduled flights. Check flight engineers rove the airline making routine inspections of all engineers at work, not only to see that they are doing the job properly but also to bring them up to date on new methods or additional improvements.

According to TWA's flight-engineer supervisors, the general trend in transport design indicates a favorable future for the flight engineer. He has become a technological aid, and as the airplane continues to grow more exact, his place in its operation may become even more important.

Inevitably flight engineering will continue to expand the range of top-notch aircraft mechanics, making it possible for them to increase their incomes (starting salary: $420 per month) and also to see something of the world outside the hangar.

Among TWA's 350 flight engineers—150 of whom are assigned to international routes—many former ground mechanics have already flown more than 2,000,000 miles in *Constellation* cockpits, covering the airline's 32,000 miles of skyways.

Care and Caution . . .

(*Continued from page 54*)

High engine transfer ring leakage.	Replace rings according to engine manufacturer's specifications.
Erroneous reading tachometers or manifold pressure gages.	Calibrate instruments.

FAILURE TO FEATHER

Probable Cause	*Remedy*
Aircraft batteries low.	Recharge or replace batteries.
Faulty aircraft electrical system.	Check wiring system pertaining to feathering pump and control circuit.
Failure of push button to remain engaged.	Check battery and low-pressure setting of cut-out switch.
Failure to remain feathered with push button failing to disengage.	Re-set cut-out switch and check electrical control circuit.
Windmilling of propeller in high-pitch angle.	Reset high-pitch stop ring.
Restricted oil supply to feathering pump.	Check feather line inlet.

ROUGHNESS

Probable Cause	**Remedy**
Ice on propeller.	Increase rpm for short time, and start deicing fluid if available.
Propeller unbalance.	Land and check balance (effect will be greater at high rpm).
Blade angles vary among blades.	Check blade angles with protractor or blade scribe mark.
Blade out of track.	Check blade track.
Spark plug or ignition.	Replace spark plugs and check wiring.
Engine part failure.	Feather propeller if feathering installation, otherwise reduce rpm to minimum.
Unknown cause (resulting in excessive vibration).	Feather propeller for continued flight if feathering installation, otherwise reduce rpm to minimum.

POOR SYNCHRONIZATION

Probable Cause	*Remedy*
Ignition trouble.	Check with ignition tester.
Poor carburetion.	Consult engine or carburetor manual.
Excessive engine transfer ring leakage.	Replace rings according to engine manufacturer's specifications.
Sludge in governor pilot valve or relief valve.	Disassemble and clean.
Air in propeller system.	Operate controls two or three times between high and low rpm during run-up.

VOR-DME Airway Tests Begun

Omnirange-Distance Measuring Equipment in Experimental Use

By N. F. Silsbee

Seven major airlines and the military services have installed a couple of dozen airborne DME units, loaned by the CAA, and have begun operational tests which will probably run until next fall.

An experimental VOR-DME airway has been set up between New York and Chicago, with stations near Caldwell, New Jersey, Allentown, Selinsgrove, Philipsburg, Pennsylvania, Youngstown, Cleveland, Toledo, Ohio, Millersburg, Indiana, and Chicago Heights, Ill. DME ground equipment was manufactured by the Federal Telephone and Radio Corporation, Clifton, N.J. The Hazeltine Electronics Corporation of Little Neck, L.I. is also producing DME ground equipment for the CAA.

Hazeltine is also in the late development phase of airborne DME units. The sets loaned by the CAA to the military services and the airlines are modified versions (with ARINC cooperation) of the Federal Telecommunications DIA airborne unit. The airlines working the tests include American, Capital, Eastern, Northwest, Pan-American, Trans-World and United.

Distance and direction from a known ground point are the two items of information necessary (plus altitude) to establish position in air navigation. On the airways of the very near future, the VHF Omnidirectional Range (VOR or omnirange, for short) will provide the primary source of directional information, and distance information will come through DME.

It was planned as a fundamental part of the Transition Program that a DME ground station will be installed at each VOR and ILS site. The advantages of "continuous fixing" which is made possible by the VOR-DME combination are no less important in air traffic control than to the pilot in enroute navigation and terminal area approach. Controllers will be provided with a source of information as to the exact positions of aircraft at all times, and the increased accuracy in position reporting will facilitate handling of arrivals and departures at busy terminals and afford greater flexibility in the control of enroute aircraft.

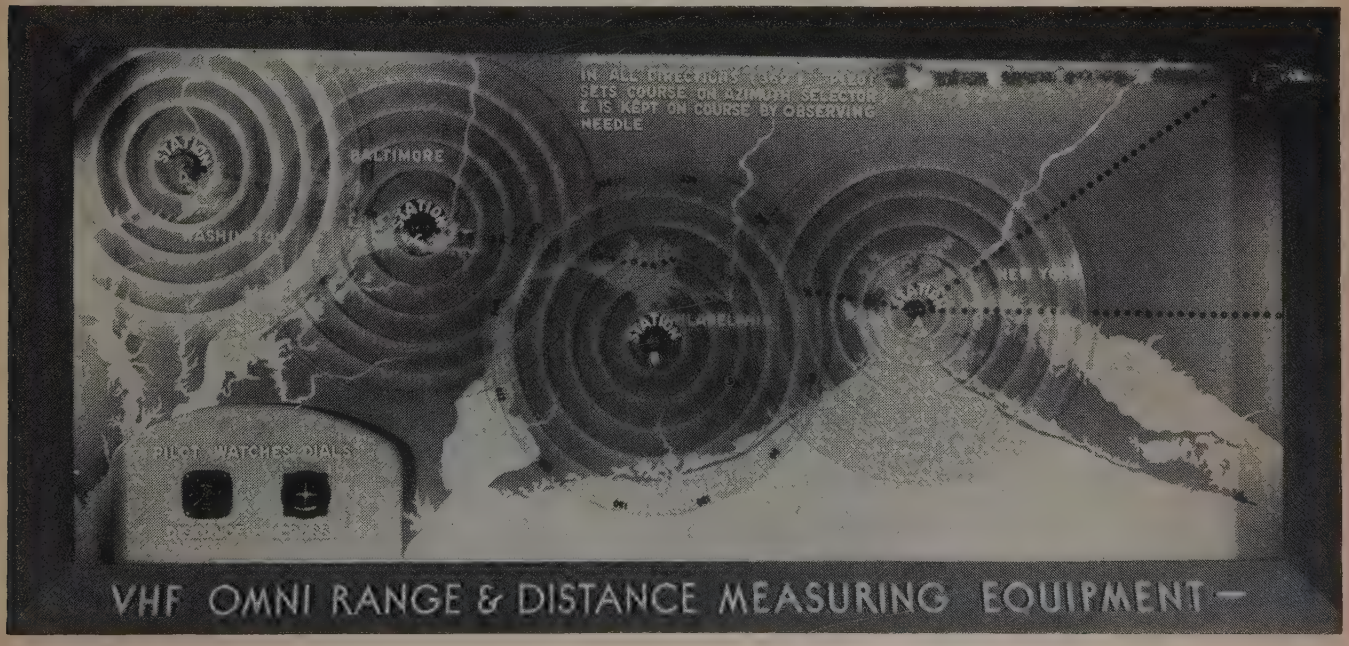
The airborne unit is known as an Interrogator-Responser—a radio transmitter-receiver combination which emits interrogating pulse signals to and receives reply signals from an automatic pulse receiver-transmitter known as a Transponder (ground equipment).

While DME makes considerable use of radar techniques, it differs from the latter in that (1) the distance is measured to a known point, (2) the ground point replies with a reinforced signal instead of just an echo and, therefore, permits greater ranges with smaller equipment, (3) the ground point can reply with a characteristic signal of its own to reveal its identity, and (4) the interrogator and ground reply are omnidirectional.

Here is how it works. The pilot turns on his Interrogator-Responser which emits a coded signal. This is picked up by the DME antenna inside the "stovepipe" on top of the plastic "derby hat" structure atop every VOR station. The receiver decodes the signal and retransmits it at high power with a reply code of its own. The airborne receiver accepts this reply signal, decodes it, and measures the time that has elapsed between transmission of the interrogation and receipt of the reply. It translates this time of transmission into distance

(*Continued on page 62*)

CAA DISPLAY depicts operational use of VHF Omnirange and Distance Measuring Equipment on airways from New York to Washington



Omnirange-DME in Experimental Use on the Airways

(*Continued from page 61*)

and displays this distance on an indicator which can be read by the pilot.

DME will operate in the UHF band, between 960 and 1215 mc. As a start, 10 radio frequencies have been selected at the low end of the band for the air-to-ground equipment. They lie between 960 and 985 mc, spaced 2.5 mc apart. Ten additional frequencies at the other end of the band (1190 to 1215 mc, 2.5 mc apart) for the ground-to-air reply signals have been selected. By the use of cross-banding and pulse multiplexing, each of these channels is made to produce 10 operating channels, or a total of 100 air-to-ground and 100 ground-to-air operating channels.

Each aircraft can measure its distance to any one of the 100 transponders because each transponder replies only to a coded interrogation. The interrogating signal consists of a pair of *r-f* pulses whose combination of pulse spacing and frequency is accepted by only one transponder beacon. The ground transponder replies with a pair of *r-f* pulses whose spacing and frequency are characteristic again of that transponder only. Circuits known as decoders sort out pulses having the desired spacings from others.

Each DME transponder beacon can service 50 aircraft. Each aircraft can separate the replies to its own interrogation from the replies to the interrogations of the same transponder by other aircraft because its own replies always occur at a nearly constant time after the interrogation (based on a calibrated "time delay" technique), while the replies to other aircraft appear evenly divided over all the time. In actual operation the receiver of each aircraft is turned on for only a very short time when the reply is expected and shut off the rest of the time. Since the receiver is open for less than 1/1000th part of the total time, the unwanted replies would have to be 1,000 times more numerous than the desired replies before the receiver would accept as many of the unwanted replies as of the wanted replies.

To illustrate this rather subtle point, Mr. C. J. Hirsch, Hazeltine Electronics engineer, greatly intrigued a Radio Technical Commission for Aeronautics (RTCA) Assembly in Washington with the following analogy:

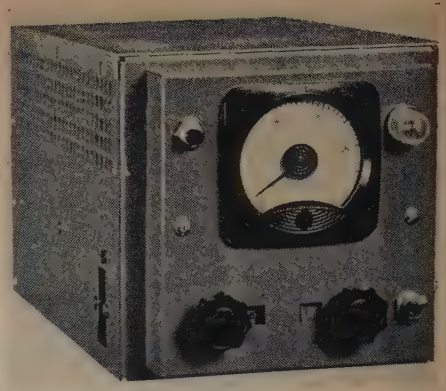
"Consider the case of a nearsighted boy who throws a ball against a wall and catches it after it bounces back to him. After a few trials, he will know how long it takes for that ball to make a round trip. He can then close his eyes all the time except when he knows the ball is due back, at which time he opens his eyes and catches the ball.

"If now there are several boys bouncing balls against the same wall, the first boy will ignore the other balls because his eyes will be closed when the other balls are within his reach. He can then play his game independently of the other players, although the same wall is used to bounce the balls of several players!

"The DME airborne receiver does just this. The time during which the receiver is open is called a gate or a stroke. This gate must open prior to the receipt of the reply and remain open long enough after that reply to receive replies which occur earlier or later by a small amount. This extra time allows for the change in distance as the airplane moves toward or away from the transponder."

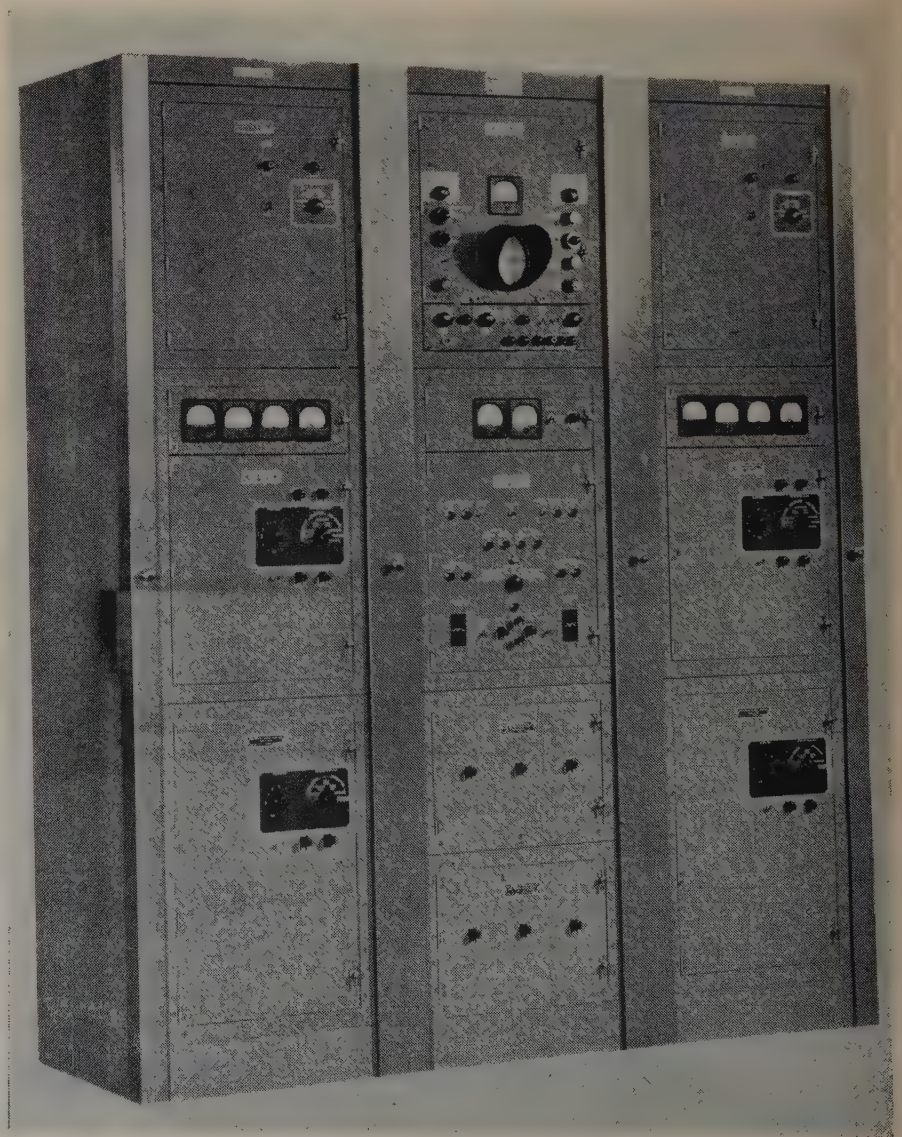
In addition to the installations on the VOR-DME experimental airway from New York to Chicago, DME installations are in operation at the CAA Technical Development and Evaluation Center, Indianapolis; USAF All-Weather Flying Division, Wright-Patterson AFB, Dayton; Patuxent Naval Air Station, Maryland; and Washington National Airport. Several others are under way.

The Air Navigation Development



AIRBORNE DME units (engineering model shown here) are ready for airways use

GROUND DME STATION equipment was manufactured by the Hazeltine Electronics Corporation



Board (ANDB) has awarded CAA development contracts for a lightweight low-cost DME airborne unit (Interrogator-Responser) suitable for use in smaller commercial and private aircraft. The contracts went to two companies: Hazeltine Electronics Corporation and National Aeronautical Corporation (NARCO), in order to determine the merits of different techniques. Reports from the CAA Technical Development center at Indianapolis (usually referred to as "TD") indicate that good progress is being made on experimental "breadboard" models by both companies.

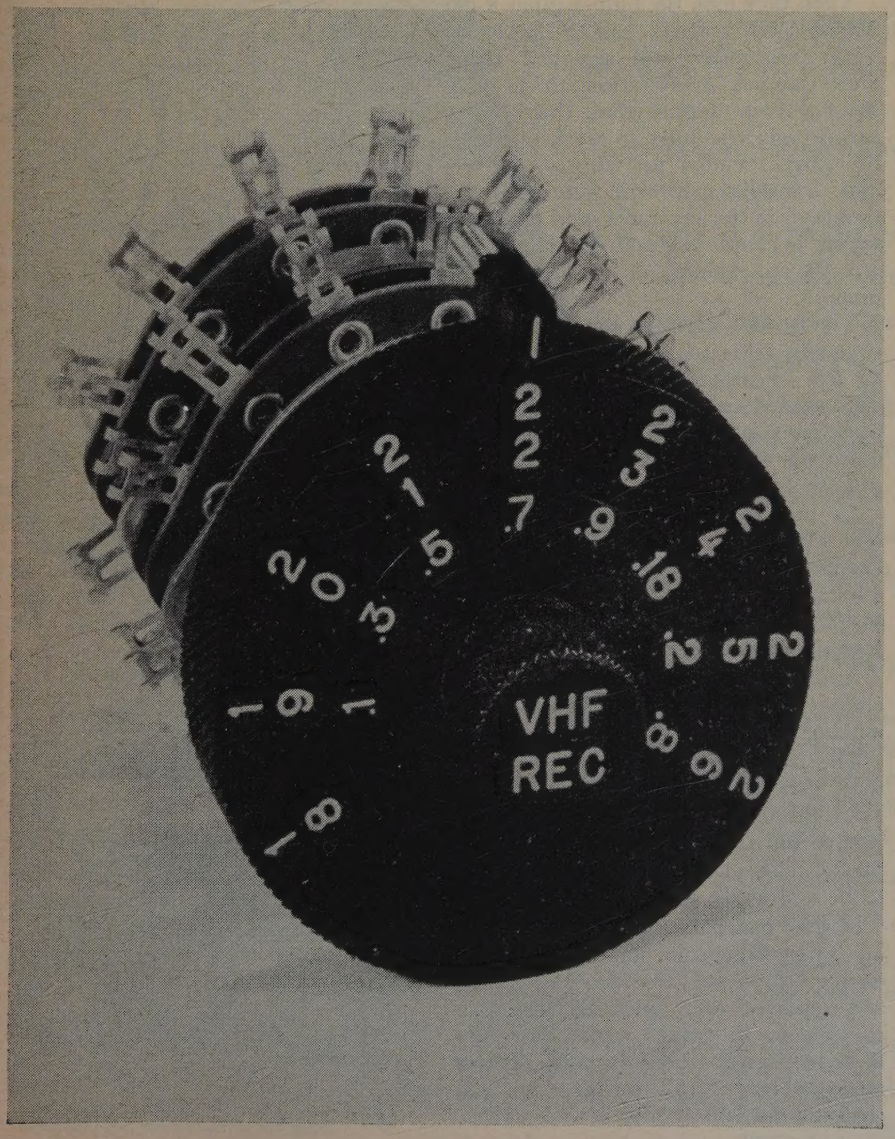
Modification for VHF Communication Sets

Operators of multi-engine corporate aircraft will be interested in details of a direct-reading switch which may be used to control the 40-channel ARC-3, the 40-channel ARC-5 or the 50-channel ARC-1. The switch was designed by J. D. Reed Co., Inc., Beechcraft distributors, Municipal Airport, Houston, Texas (also at New Orleans, La. and Love Field, Dallas). It was specifically built for the Reed Company's multi-channel modifications of the ARC-5 and ARC-3, and also found suitable for the AERO-COM (Miami) 50-channel modification of the ARC-1, now standard equipment on most U. S. scheduled airlines and purchased by some company airplane owners *(see SKYWAYS, September 1951, page 64)*.

When the J. D. Reed Company received a copy of the order amending Section 9.312 of the FCC's Rules and Regulations Governing Aeronautical Services (issued Aug. 15, 1951) it was realized that some 35 to 40 transmitting channels would be required immediately by corporations and other operators of multi-engine aircraft. It meant that all VHF channels from 118.1 to

(Continued on page 64)

DIRECT READING SWITCH was developed by J. D. Reed Company for ARC-3 and ARC-5



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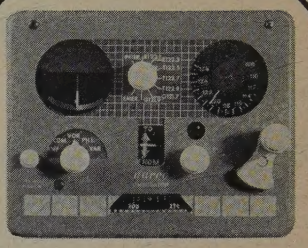

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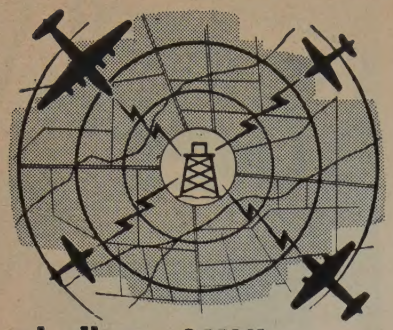

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Aerodynamacists give a startling answer to the problem of can one jet push a flamed-out jet back to home base.

On Sale February 8th

Modification For VHF Communication Sets

(*Continued from page 63*)

126.7 mc had become an effective part of the "common system," available to any aircraft which had the equipment to use them.

Heretofore, as wartime VHF radio sets and other equipment were modified for more and more channels (for example, ARC-1 to 20-channels, ARC-3 to 24, etc.), the placards and lists in the cockpits got longer and longer until they were no longer practical.

A team of Reed Company radio technicians headed by R. D. Moore, Chief of Radio Maintenance, studied the situation and were much impressed with the simplicity of controlling the Bendix and Collins 280-channel navigational and communications receivers. They designed and made a switch which covered all the frequencies listed in the FCC amendment and indicated them directly in megacycles and tenths (*see photo*).

Then they took the four-channel R-28 ARC-5 VHF receiver and T-23/ARC-5 VHF transmitter and designed their multi-channel modification to fit the switch. They report that there were surprisingly few bugs to work out and the project ended up with a receiver and transmitter which were entirely standard as far as racks and existing wiring is concerned, and entirely standard in appearance, *i.e.*, no boxes or bumps.

The R-28/ARC-5 receiver covers 20 channels, achieved by selecting any one of five crystals in the standard four channels. Moore reports that if the frequencies are selected carefully it has a sensitivity well below the normal squelch level.

In the T-23/ARC-5 transmitter any one of 10 crystals in the standard four channels may be selected, making it a 40-channel transmitter. It provides a 7 to 10-watt output with 100 per cent modulation on all channels.

A standard ARC-5 set-up would include two receivers and one transmitter, making it 40 channels simplex.

The frequencies normally covered in the 40-channel modification include 118.1 through 121.9; transmit on 122.1, receive on 122.2 (double channel simplex); 122.8; 123.7 through 125.9 (yet to be activated); and 126.7 mc.

Several installations have been made on Twin Beechcraft and other multi-engine corporate aircraft, and pilots are reported well pleased with the equipment. In planes where only one R-28 receiver has been installed, it was made to cover 118.1 to 121.9 mc (20 channels in odd tenths of megacycles, providing 200-kc separation). Pilots of those planes all plan to add a second receiver when the 123-126 mc band is activated.

To complete the story, the Reed Co. reports that the operator of a Sun Oil Twin-Beech in Dallas saw the 40-channel switch and brought in his eight-channel AN/ARC-3 set for modification to a 40-channel unit using the direct reading switch. This modification was also reported as entirely successful.

These 50- and 40-channel modifications to the ARC-1, ARC-3 and ARC-5 are admittedly not the last word in VHF communications equipment, but they provide a very useful series of interim units for the next few years.

Lear Announces New Three-in-One Communications Set

Pilots of corporate and personal aircraft will be interested in Lear's new LTRA-6 communications system, combining in one compact unit a VHF receiver, VHF transmitter and L/MF receiver.

The VHF transmitter provides up to 12 channels in the 118.1 to 126.7 mc band. The VHF receiver covers the communications band (118 to 127 mc), and may also be used as a navigation receiver (108 to 117 mc). When used with the Lear *Omniscope* (VOR indicator) and *Omnipack*, the LTRA-6 offers continuous automatic magnetic bearings for omnirange navigation (112 to 117 mc). Used in conjunction with the Lear VCIX indicator and VCA adapter, it enables the pilot to use the visual-aural ranges for enroute navigation and ILS runway localizers for approach procedures (108 to 111 mc). The 75 mc marker signal is received on a separate circuit.

The L/MF receiver enables the pilot to use the four-course L/F ranges (200 to 400 kc) and the broadcast band.

The unit weighs just six pounds, and costs $459.50; installation and other components, *i.e.*, antenna, etc., are extra.

LEAR LTRA-6 weighs just six pounds

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